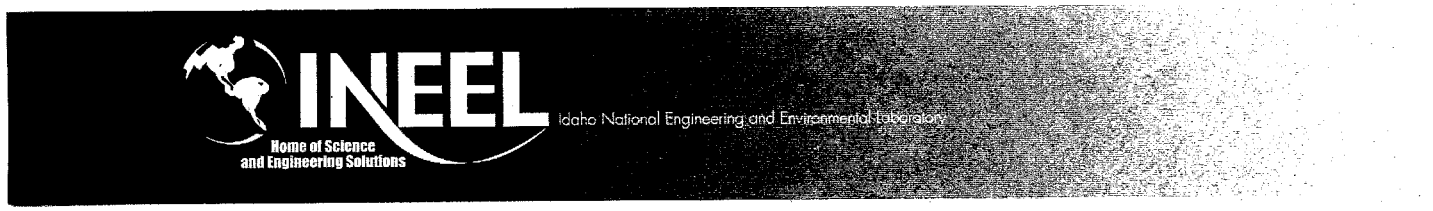
DOE/ID-10587
Revision 7
September 2002

U.S. Department of Energy
Idaho Operations Office

Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites



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Prepared for the
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Revision 7

September 2002

Approved by

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Environmental Restoration

9/12/02
Date

R. G. Thompson
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09/12/2002
Date

Approval via e-mail
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07/08/2002
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ABSTRACT

This Quality Assurance Project Plan (QAPjP) was prepared for use by the Environmental Restoration, Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites Department at the Idaho National Engineering and Environmental Laboratory. This QAPjP discusses the quality assurance and quality control requirements for numerous projects at the Idaho National Engineering and Environmental Laboratory. The standard analytical laboratory methods used for analysis are referenced in this QAPjP. Also, the various sample holding times, sample sizes, and preservation requirements are provided. This QAPjP meets the requirements of a Category III Quality Assurance Program Plan as defined by the Environmental Protection Agency. This document was prepared to meet the requirements and guidance contained in *Environmental Protection Agency Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA QA/R-5) and EPA *Guidance for Quality Assurance Project Plans* (EPA QA/G-5).

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ACRONYMS

%R	percent recovery
AEF	Argonne Experimental Facility
AMDV	analytical method data validation
ANP	aircraft nuclear propulsion
ANSI	American National Standards Institute
ARA	Auxiliary Reactor Area
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
ATR	Advanced Test Reactor
BBWI	Bechtel BWXT Idaho, LLC
BORAX	Boiling Water Reactor Experiment (Area)
CAS	Chemical Abstract Service
CER	contractor expanded review
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	contaminant of concern
COPC	contaminant of potential concern
CP	Chemical Waste Pond
CRDL	contract-required detection limit
CRQL	contract-required quantification limit
CTF	Contained Test Facility
CWP	Cold Waste Pond
D&D	decontamination and decommissioning

D&D&D	deactivation, decontamination, and decommissioning
DA	determinative analysis
DAR	Document Action Request
DDP	decision documental package
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DQA	Data Quality Assessment
DQO	data quality objective
EBR	Experimental Breeder Reactor
EPA	Environmental Protection Agency
EQL	estimated quantitation limit
ER	environmental restoration
ERIS	Environmental Restoration Information System
ESH&QA	Environmental, Safety, Health, and Quality Assurance
ETR	Engineering Test Reactor
FDC	Field Data Coordinator
FFA/CO	Federal Facility Agreement and Consent Order
FSP	Field Sampling Plan
FTL	field team leader
GC/MS	gas chromatography/mass spectrometry
GDE	guide
HASP	Health and Safety Plan
HAZWOPER	hazardous waste operator (training)
HDPE	high-density polyethylene
I&MCA	inorganic and miscellaneous classical analyses
ICDF	INEEL CERCLA Disposal Facility

ICPP	Idaho Chemical Processing Plant
ID	identification
IDEQ	Idaho Department of Environmental Quality
IEDMS	Integrated Environmental Data Management System
IET	Initial Engine Test (facility)
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
L&V	limitations and validation
LCCDA	Liquid Corrosive Chemical Disposal Area
LCS	laboratory control sample
LDPE	low-density polyethylene
LPEP	Laboratory Performance Evaluation Program
MCL	maximum contaminant level
MCP	management control procedure
MD	mean difference
MDA	minimum detectable activity
MDL	method detection limit
MOSA	methods of soil analysis
MS	matrix spike
MS/MSD	matrix spike/matrix spike duplicate
MTA	Master Task Agreement
MTR	Materials Test Reactor
MTS	Master Task Subcontract
NCSL	National Conference of Standards Laboratories
ND	non detect
NOAA	National Oceanic and Atmospheric Administration

NODA	Naval Ordnance Disposal Area
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NSIF	new site identification form
O&M	operation and maintenance
OIS	Optical Imaging System
OMRE	Organic-Moderated Reactor Experiment
ORD	ordinance
OSHA	Occupational Safety and Health Administration
OU	operable unit
PAR	precision of the absolute range
PBF	Power Burst Facility
PCB	polychlorinated biphenyls
PE	performance evaluation
PM	project manager
PRG	preliminary remedial goal
QA	quality assurance
QA/QC	quality assurance/quality control
QAPjP	Quality Assurance Project Plan
QC	quality control
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RDL	required detection limit
RD/RA	Remedial Design/Remedial Action
RDX	Research Development Explosive

RFP	Request for Proposal
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RPD	relative percent difference
RQL	required quantitation limit
RSD	relative standard deviation
RWMC	Radioactive Waste Management Complex
SADTS	Sample and Data Tracking System
SAP	Sampling and Analysis Plan
SDA	Subsurface Disposal Area
SDG	Sample Delivery Group
SDWA	Safe Drinking Water Act
SFE	stored fuel exterior
SLP	Sewage Leach Pond
SMC	Specific Manufacturing Capability (Facility)
SMO	Sample Management Office
SOP	standard operating procedure
SOW	Statement of Work
SPERT	Special Power Excursion Reactor Test
SRPA	Snake River Plain Aquifer
SRM	standard reference material
SSSAJ	Soils Science Society of American Journal
STF	Security Training Facility
SVOC	semivolatile organic compound
TAL	target analyte list

TAN	Test Area North
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TNT	trinitrotoluene
TOS	Task Order Statement of Work
TPH	total petroleum hydrocarbon
TPR	technical procedure
TRA	Test Reactor Area
TRU	transuranic
TSF	Technical Support Facility
UST	underground storage tank
UTS	Universal Treatment Standards
UXO	unexploded ordnance
VOC	volatile organic compound
WAG	waste area group
WERF	Waste Experimental Reduction Facility
WRRTF	Water Reactor Research Test Facility
WWP	Warm Waste Pond
ZHE	zero headspace extraction

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The Idaho National Engineering and Environmental Laboratory (INEEL) contractor controls this Quality Assurance Project Plan (QAPjP) for the Department of Energy. Each revision to this QAPjP will receive a complete review and approval by the Department of Energy Idaho Operations Office, Idaho Department of Environmental Quality, and Environmental Protection Agency, Region X.

Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites

1. PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPjP) is for use by the Environmental Restoration (ER) Waste Area Groups (WAGs) 1, 2, 3, 4, 5, 6, 7, 10, and the Inactive Sites Department at the Idaho National Engineering and Environmental Laboratory (INEEL). It presents the functional activities, organization, and quality assurance/quality control (QA/QC) protocols to achieve the data quality objectives (DQOs) dictated by the end use of the data. This QAPjP pertains to all environmental, geotechnical, geophysical, and radiological sampling, testing, measurement, and data review activities for WAGs 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites. Also, presented are the standard and routine analytical methods used for analyzing samples. This QAPjP meets the requirements of Environmental Protection Agency (EPA) QA/R-5 and EPA QA/G-5. This QAPjP is used in conjunction with a site-specific Field Sampling Plan (FSP) or other test plan. A list of items that must be included in an FSP using this QAPjP is included in Appendix A. Together this QAPjP and the FSP or test plan form a functional Sampling and Analysis Plan (SAP).

1.1 Project Organization

This section provides the reader (Department of Energy [DOE], EPA, Idaho Department of Environmental Quality [IDEQ], INEEL contractor, and others) with a general understanding of the program organization, the role of the various parties involved in the investigations, and the lines of authority and reporting for the program and projects. Project-specific organization, roles, lines of authority, and reporting are in the FSP or test plan and in project-specific health and safety plans (HASPs).

1.1.1 Participants

The principal participants under the Federal Facility Agreement and Consent Order (FFA/CO) are the State of Idaho, EPA Region X, and Department of Energy Idaho Operations Office (DOE-ID). Appendix D of the FFA/CO Action Plan lists the following project managers from each agency:

- Mr. J. Lyle, U.S. Department of Energy, Idaho Field Office
- Mr. W. Pierre, Chief Federal Facility Section, U. S. Environmental Protection Agency
- Mr. D. Nygard, Program Manager, Idaho Department of Environmental Quality.

Other participants include the WAG managers assigned by the project managers; the INEEL contractor ER director and assigned WAG managers; the INEEL contractor ER Environmental Safety, Health, and Quality (ESH&QA) manager and compliance professionals; subcontractors hired by the INEEL contractor to perform work at one or more of the operable units (OUs); and those individuals listed on the distribution list for this QAPjP. Figure 1-1, "Basic organization and communications chart of FFA/CO participants," provides a general relationship between participants.

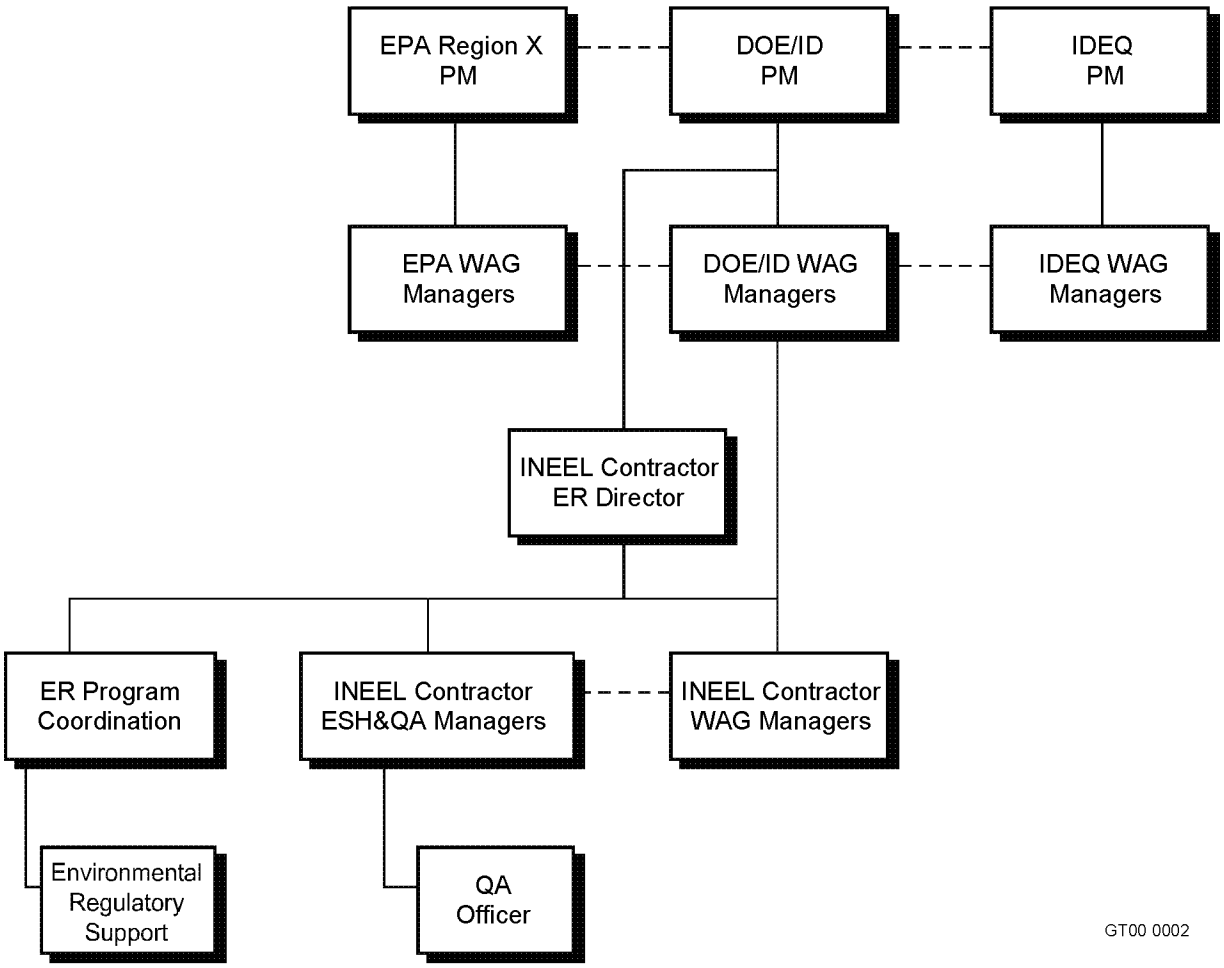

Figure 1-1. Basic organization and communications chart of FFA/CO participants.

1.1.2 Roles and Responsibilities

As described in the *FFA/CO Action Plan* (INEL 1991b), Section 4, the DOE/ID, IDEQ, and EPA Region X project managers (PMs) have the following roles and responsibilities:

- Manage INEEL remedial activities for their respective agencies pursuant to the FFA/CO and Action Plan
- Serve as primary contacts and coordinators for their respective agencies for purposes of implementing the FFA/CO and Action Plan
- Prioritize work
- Coordinate activities of WAG managers as necessary
- Approve and sign "No Further Action Determinations"
- Evaluate and approve change to OUs based on investigation findings
- Prepare monthly progress reports.

The WAG managers are assigned the following roles and responsibilities by the FFA/CO:

- Manage remedial activities under the Action Plan at assigned WAG(s) under the direction of project manager
- Serve as agency contact for the project manager for assigned WAG(s)
- Participate in project management meetings as requested by project managers.

The ER ESH&QA manager provides quality assurance, industrial safety, industrial health, radiological engineering, and radiological control technician support to the projects. The specific roles, activities, and responsibilities of the above-named personnel and organizations and the internal lines of authority and communication within and between organizations are described in the *ER Project Management Plan* (DOE-ID 1994), *Implementing Project Management Plan* (INEEL 1998), facility- and process-specific safety analysis reports, auditable safety analyses, and project-specific HASPs.

The manager of Environmental Restoration Program Coordination maintains a staff of environmental regulatory professionals to support all of the WAGs and Deactivation, Decontamination, and Decommissioning (D&D&D).

1.2 Problem Definition/Background

The background information provided in this section provides a high-level discussion of the problems in historical perspective, giving participants of the QAPjP a basic understanding of the INEEL ER scope. Project-specific FSPs, test plans, work plans, and other project-specific documents provide both the historical perspective for a particular site and the exact nature of the problems.

1.2.1 Overview of the INEEL

The INEEL (see Figure 1-2) was proposed for listing on the National Priorities List (NPL) on July 14, 1989. The final rule that listed the INEEL on the NPL was published on November 21, 1989. Before the NPL listing, environmental characterization work had been conducted under a Consent Order and Compliance Agreement between the DOE and the EPA in accordance with the Resource Conservation and Recovery Act (RCRA).

Following the NPL listing, an FFA/CO (INEL 1991a) was negotiated among the DOE, EPA, and State of Idaho to implement characterization and remediation in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The action plan for implementing the FFA/CO has two "tracks" for an OU that requires field data collection: a Preliminary Scoping Track 1 and a Preliminary Scoping Track 2 investigation or a remedial investigation (RI). In both cases, the goal is to determine if the risk(s) posed by the site are unacceptable as defined by the National Contingency Plan and, if necessary, provide information for remedy selection and remedial design.

The remainder of the steps in the CERCLA process, as described in the FFA/CO, is interim action planning, remedial investigation/feasibility study (RI/FS) scoping process, RI/FS implementation, decision process, Record of Decision (ROD) schedule, post-ROD process, remedial design/remedial action (RD/RA) process, remedial design process, remedial action process, and operation and maintenance (O&M).

1.2.2 Overview of the Various WAGs

1.2.2.1 WAG 1—Test Area North. Test Area North (TAN) encompasses several areas: the Technical Support Facility (TSF); Initial Engine Test (IET) Facility; Contained Test Facility (CTF), previously known as the Loss-of-Fluid Test Facility; Specific Manufacturing Capability (SMC) Facility; and Water Reactor Research Test Facility (WRRTF).

In general, TSF consists of facilities for handling, storage, examination, and research and development of spent nuclear fuel. The Process Experimental Pilot Plant, a facility originally built to determine the capabilities of processing transuranic waste destined for the Waste Isolation Pilot Plant, is also located here and undergoing D&D&D.

The IET is an abandoned facility north of TSF that has numerous historical sites and is undergoing D&D&D. The IET was designed as a testing location for the nuclear jet engines developed under the Aircraft Nuclear Propulsion (ANP) Program in the 1950s and early 1960s.

The CTF and the SMC are contiguous facilities west of TSF that consist of structures built for those two operations and an old building from the ANP Program. The CTF is an inactive facility originally constructed for nuclear reactor tests. The SMC is an active facility manufacturing components for a U.S. Department of Defense non-nuclear weapons system.

The WRRTF primarily consists of two buildings southeast of TSF that have housed several non-nuclear tests, mostly for simulating and testing water systems used in reactors.

The boundary of WAG 1 includes the TSF, IET, CTF, SMC, and WRRTF fenced areas. It also includes the immediate areas outside the fences, where operations associated with these areas may have taken place, and all surface and subsurface areas.

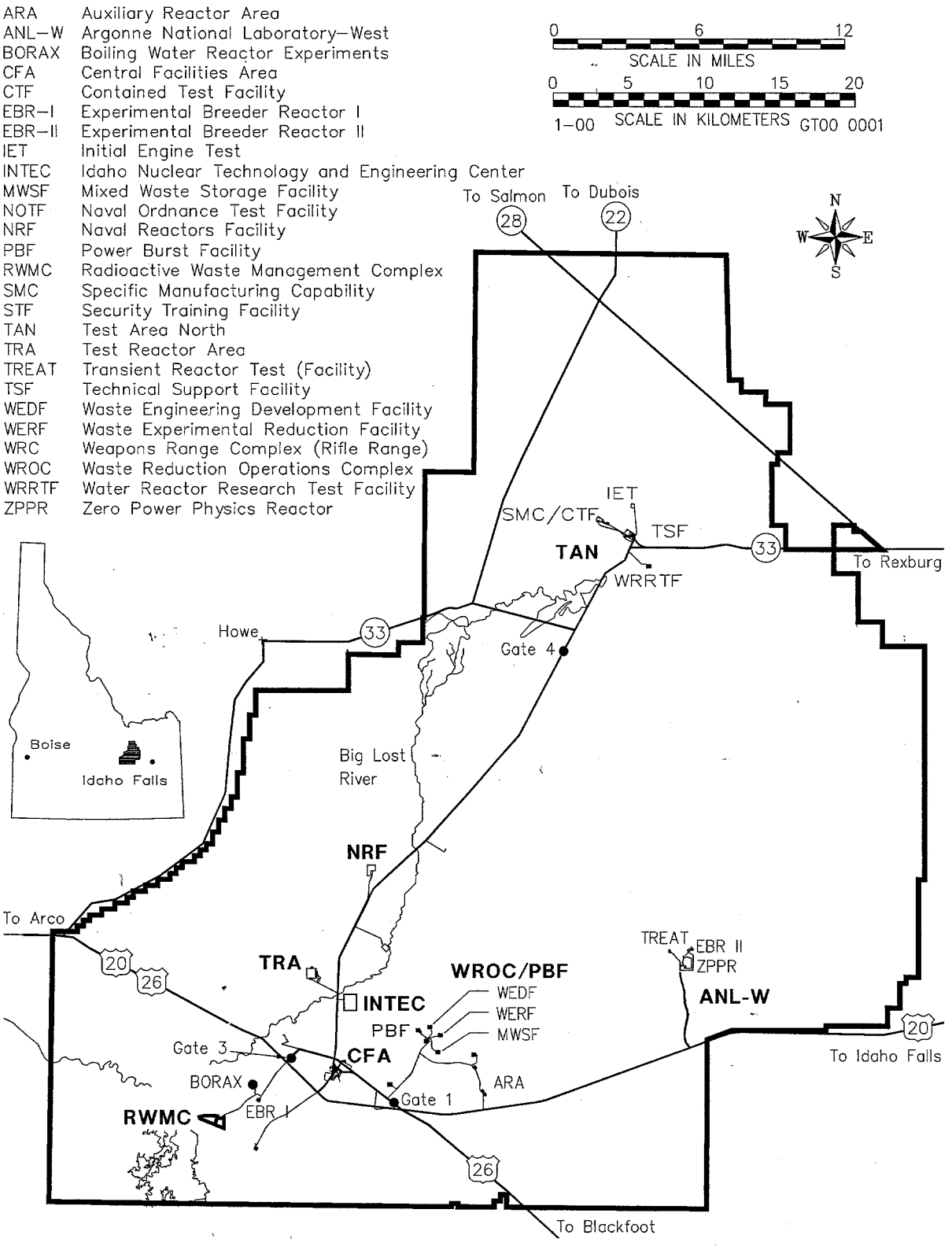

Figure 1-2. Map of the INEEL.

Waste Area Group 1 will implement the OU 1-10 Comprehensive ROD. The OU 1-10 RD/RA will remediate sites shown to present unacceptable risks to human health and the environment. The areas requiring remediation include three highly contaminated sites where mixed-waste tanks are buried, buried mixed-waste tank sites, three soil sites contaminated with radionuclides or petroleum, and two burn pit sites contaminated with metals and possibly other constituents.

Waste Area Group 1 must also implement the OU 1-07B ROD and explanation of significant differences. The OU 1-07B remedial action must reduce volatile organic compounds contamination in the aquifer to below maximum contaminant levels (MCLs) using treatability studies, hydraulic containment, and pump and treat.

1.2.2.2 WAG 2—Test Reactor Area. The Test Reactor Area (TRA) was established in the early 1950s in the southwestern portion of the INEEL, approximately 76 km (47 mi) west of Idaho Falls. The TRA houses extensive facilities for studying the effects of radiation on materials, fuels, and equipment, including high neutron flux nuclear test reactors. Three major reactors have been built at TRA: (1) the Materials Test Reactor (MTR), (2) the Engineering Test Reactor (ETR), and (3) the Advanced Test Reactor (ATR). The ATR is currently the only major operational reactor within TRA.

Chemical and radioactive wastes are generated from scientific and engineering research at TRA. Although extracted and treated, the wastes still contain low-level radioactive and chemical solutions that must be disposed of. As originally designed and installed, two separate waste streams were used at TRA, one for sanitary sewage and the other for all waste streams. Over the years, additional segregation of waste streams has taken place. Historical disposal sites for the waste include the Chemical Waste Pond (CP), Cold Waste Pond (CWP), disposal well, retention basin, Sewage Leach Pond (SLP), and Warm Waste Pond (WWP). In addition to these sites, there have been other releases associated with spills and leaking underground storage tanks.

Potential release sites identified at TRA facilities in the FFA/CO include wastewater structures and leaching ponds, underground storage tanks, rubble piles, cooling towers, an injection well, French Drains, and assorted spills. These 66 potential release sites compose 13 action OUs and one "no action" OU.

Possible contaminants of potential concern (COPCs) include petroleum products, acids, bases, polychlorinated biphenyls (PCBs), radionuclides, and metals. These are the chemical and radioactive wastes generated from the scientific and engineering research at TRA. The boundary of WAG 2 includes the area within the TRA fence and the areas immediately outside the fence where waste operations have taken place. Waste Area Group 2 includes all surface and subsurface areas.

1.2.2.3 WAG 3—Idaho Nuclear Technology and Engineering Center. Waste Area Group 3 is the Idaho Nuclear Technology and Engineering Center (INTEC) that houses facilities for reprocessing government defense and research spent fuel. Facilities at INTEC include spent fuel storage and reprocessing areas, a waste solidification by calcination facility and related waste storage bins, remote analytical laboratories, and a coal-fired steam generating plant.

The INTEC, formerly known as the Idaho Chemical Processing Plant (ICPP), is located in the south-central area of the INEEL in southeastern Idaho. Since 1952, operations at INTEC have primarily been related to the reprocessing of spent nuclear fuel from defense projects wherein reusable uranium was extracted from the spent fuels. The DOE discontinued reprocessing at the facility in 1992. Liquid waste generated from the activities prior to 1992 is stored in an underground tank farm. Treatment of this waste using a calcining process is ongoing at the facility. This process converts the liquid to a more stable granular form; the calcined solids are then stored in stainless steel bins. Disposition of this waste will be addressed in the INEEL High Level Waste and Facility Disposition Environmental Impact Statement. The

current mission for INTEC is to receive and temporarily store spent nuclear fuel and radioactive waste for future disposition, manage waste, and perform remedial actions.

Several phases of investigation have been performed on the OUs contained within WAG 3. A comprehensive RI/FS (OU 3-13 RI/FS) was conducted to determine the nature and extent of contamination and corresponding potential risks to human health and the environment under various exposure pathways and scenarios. On the basis of the RI/FS, the INTEC release sites were further segregated into seven groups to allow the development and analysis of remedial action alternatives with the sites grouped by contaminants of concern (COCs), accessibility, or geographic proximity. The groups, as identified in the OU 3-13 ROD, include

- Group 1—Tank Farm Soils
- Group 2—Soils Under Buildings and Structures
- Group 3—Other Surface Soils
- Group 4—Perched Water
- Group 5—Snake River Plain Aquifer (SRPA)
- Group 6—Buried Gas Cylinders
- Group 7—Stored Fuel Exterior (SFE)-20 Hot Waste Tank System.

In addition to the seven groups, the INEEL CERCLA Disposal Facility (ICDF) has been proposed for construction at INTEC to allow on-Site disposal of WAG 3 and other CERCLA-generated wastes at INEEL. The ICDF will be an engineered facility meeting RCRA Subtitle C design and construction requirements and will consist of about six cells adjacent to INTEC with a capacity of about 389,923 m^3 (510,000 yd^3) of material.

The boundary of WAG 3 includes the area within 1,000 ft of the INTEC fence and those immediately adjacent areas where waste activities have taken place, including Windblown Site CPP-95. Waste Area Group 3 includes all surface and subsurface areas.

1.2.2.4 WAG 4—Central Facilities Area. Waste Area Group 4 is designated as one of the 10 WAGs located at the INEEL. The INEEL has conducted nuclear reactor research and testing for the U.S. Government since 1949. It is managed by the DOE and occupies an area of approximately 2,305 km^2 (890 mi^2) in southeastern Idaho. Waste Area Group 4 comprises the Central Facilities Area (CFA), located in the south-central portion of the INEEL (Figure 1-1). This WAG also includes areas on the outskirts of CFA, that is, landfills, gravel pits, and surface and subsurface areas.

The original buildings at CFA, built in the 1940s and 1950s, housed Navy gunnery range personnel, administration, shops, and warehouse space. The facilities have been modified over the years to fit changing needs and now provide four major types of functional space: (1) craft, (2) office, (3) service, and (4) laboratory. Approximately 1,028 people work at CFA. Public access to INEEL is strictly controlled through the use of security personnel and security measures such as fences around sensitive facilities.

The FFA/CO identifies 52 potential release sites at WAG 4 (Figure 1-2). The types of CERCLA sites at WAG 4 include landfills, underground storage tanks, above ground storage tanks, drywells,

disposal ponds, soil contamination sites, and a sewage treatment plant. Each of these sites was placed into one of 13 OUs within the WAG based on similarity of contaminants, environment release pathways, and/or investigations.

1.2.2.5 WAG 5—Power Burst Facility and Auxiliary Reactor Area. Comprising the Auxiliary Reactor Area (ARA) and Power Burst Facility (PBF), WAG 5 is in the south-central portion of the INEEL. The INEEL is located in southeastern Idaho and occupies 2,305 km^2 (890 mi^2) in the northeastern region of the Snake River Plain (Figure 1-2). The CERCLA (42 USC 9601 et seq) identification number for the INEEL is 1000305. Land use at the INEEL is classified as industrial.

The ARA consists of four separate operational areas designated as ARA-I, ARA-II, ARA-III, and ARA-IV. Once known as the Special Power Excursion Reactor Test (SPERT) facilities, PBF consists of five separate operational areas: the PBF Control Area, the PBF Reactor Area (SPERT-I), the Waste Engineering Development Facility (SPERT-II), the Waste Experimental Reduction Facility (WERF) (SPERT-III), and the Mixed Waste Storage Facility (SPERT-IV). Collectively, the WERF, Waste Engineering Development Facility, and the Mixed Waste Storage Facility are known as the Waste Reduction Operations Complex.

Fifty-five potential release sites have been identified at WAG 5: 25 at ARA and 30 at PBF. The sources of contamination at ARA include past discharges to underground storage tanks, septic systems, and several surface ponds. A low-level radioactive waste landfill and a large windblown contamination area associated with the cleanup of a 1961 reactor accident also are sources within ARA. The sources of contamination at PBF include past discharges to underground storage tanks, vadose zone injection wells, septic systems, and several surface ponds.

The boundary of WAG 5 encompasses the facility locations presently or historically used within the PBF and ARA areas, those immediately adjacent areas where waste activities may have taken place, and all surface and subsurface areas.

1.2.2.6 WAG 6—Experimental Breeder Reactor No. 1. Waste Area Group 6 currently includes 22 potential release sites divided into five OUs (OU 6-01, 6-02, 6-03, 6-04, and 6-05). Sites within these OUs include underground storage tanks (USTs), septic tanks, two reactor burial sites, a leach pond, a trash dump, a drainage ditch, and a radionuclide-contaminated soil area. Contaminants of potential concern include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), radionuclides, petroleum waste, metals, PCBs, pesticides, and herbicides. Summary assessments, Track 1 decision documentation packages (DDPs) and Track 2 investigations and one RI/FS have been completed for potential release sites. The boundary of WAG 6 is directly related to the Experimental Breeder Reactor (EBR)/Boiling Water Reactor Experiment (BORAX) facility locations and areas immediately adjacent to them and all surface and subsurface areas.

Operable Unit 6-02 comprises the BORAX-01—BORAX II-V leach pond, BORAX-03—BORAX septic tank (Argonne Experimental Facility [AEF]-703), BORAX-04—BORAX trash dump, BORAX-08—BORAX V ditch, and BORAX-09—BORAX II-V reactor building.

The BORAX-01 leach pond received reactor cooling water and cooling tower blowdown water generated during the BORAX II-V reactor program.

The BORAX-03 septic tank (AEF-703) was a 2,271-L (600-gal) concrete underground septic tank and its associated piping, distribution box, and leach field, located 15 m (50 ft) west of AEF-605. The septic system, installed in 1962 and used until 1968, received sewage from a floor drain, service sink,

urinal, and commode. The septic tank and system were removed as part of 1995-1996 decontamination and decommissioning (D&D) activities.

The BORAX-04 trash dump was located 137 m (450 ft) from the northwest corner of the BORAX-V facility fence. It was used during construction, operation, and demolition of BORAX facilities from 1953 to 1964. All waste material was removed and the area was backfilled with noncontaminated soil, graded, and reseeded during 1985 D&D activities.

The BORAX-08 ditch (a newly identified site) was an unlined excavation that began approximately 12 m (40 ft) north of the AEF-601 reactor facility and measured approximately 477 m (1,565 ft) in length and 15 m (50 ft) in width at its widest point. It received waste stream effluent from the BORAX II-V reactors through a 10-cm (4-in.) raw water line to a 23-cm (9-in.) corrugated underground metal pipe. Sample analysis indicated that the ditch contained radioactive and metals contamination.

The BORAX-09 site, a newly identified site consisting of the BORAX II-V Reactor Facility (AEF-601/ANL-717), was the site of a series of reactor experiments conducted between 1953 and 1964. A D&D removal and containment action was conducted at BORAX-09 during 1996 and 1997 to remove RCRA (42 USC § 6901 et seq.) hazardous materials and leave this site in a safe and stable condition. A contamination source (radionuclide contaminated soil) remains in place.

Operable Unit 6-03 consisted of 10 inactive USTs: BORAX-05—BORAX fuel oil tank southwest of AEF-602; BORAX-07—BORAX inactive fuel oil tank by AEF-601; EBR-07—EBR-I (AEF-704) fuel oil tank at AEF-603; EBR-08—EBR-I (WMO-703) fuel oil tank; EBR-09—EBR-I (WMO-704) fuel oil tank at WMO-601; EBR-10—EBR-I (WMO-705) gasoline tank; EBR-11—EBR-I fuel oil tank (EBR-706); EBR-12—EBR-I diesel tank (EBR-707); EBR-13—EBR-I gasoline tank (EBR-708); and EBR-14—EBR-I gasoline tank (EBR-717).

Operable Unit 6-04 consisted of the EBR-15 radionuclide-contaminated soil comprising four regions surrounding the EBR-601 reactor facility. Samples collected from EBR-15 during OU 10-06 characterization contained radionuclide concentrations high enough to warrant accelerated cleanup. Cleanup included excavation of radionuclide-contaminated soil, approximately 980 m^3 (1,279 yd^3), from all detectable sources within the EBR-I perimeter fence. Following radionuclide-contaminated soil excavation, samples were collected to verify cleanup goals were met. Based on field readings, less than 0.9 m^3 (1 yd^3) of radionuclide-contaminated soil exceeding preliminary remediation goals remains in one small area where a fence post and basalt outcropping prevented its complete removal. In addition, because the scope of OU 10-06 was radionuclide-contaminated soil, some radionuclide-contaminated piping was left underground when uncovered. A new site identification form (NSIF) is in progress for the underground piping to determine if the piping should become a CERCLA site.

Operable Unit 6-05 is the WAG 6 comprehensive RI/FS.

1.2.2.7 **WAG 7—Radioactive Waste Management Complex.** The Radioactive Waste Management Complex (RWMC) was established in 1952 and is a controlled area for the disposal of solid radioactive wastes generated during INEEL operations. The primary RWMC site being investigated is the Subsurface Disposal Area (SDA) within the RWMC. It includes numerous pits, trenches, and vaults where radioactive and organic wastes were placed, as well as a large pad where waste was placed above grade and covered. The Transuranic Storage Area within the RWMC has been used since the early 1970s for retrievable storage of transuranic waste on earthen-covered pads and in facilities.

During the preparation of the FFA/CO and development of the OUs for WAG 7, it was envisioned that a WAG 7 investigation could be based on contaminant pathways rather than contaminant sites

(i.e., air pathway and vadose zone pathway), and OUs would be further subdivided into pits and trenches containing transuranic (TRU) radionuclides versus pits and trenches containing only low-level radionuclides. Based on this division of OUs, OU 7-13, TRU pits and trenches RI/FS was established to investigate only those portions of the SDA containing buried TRU radionuclides.

Due to the similarities of all buried waste at the SDA, the Agencies have agreed that all source team and pathway OUs associated with WAG 7 will be comprehensively evaluated in OU 7-13 RI/FS, which will also serve as the comprehensive RI/FS for WAG 7 (OU 7-14) and referred to in this document as OU 7-13/14. Waste Area Group 7 is divided into 14 OUs. The boundary of WAG 7 is clearly defined as the RWMC fence, with the SDA as a fenced portion within the RWMC. It includes all surface and subsurface areas.

1.2.2.8 *WAG 10—Miscellaneous Sites.* Waste Area Group 10 includes miscellaneous surface sites and liquid disposal areas throughout the INEEL that are not included within other WAGs. Waste Area Group 10 also includes regional INEEL-related SRPA concerns that cannot be addressed on a WAG-specific basis. Specific sites currently recognized as part of WAG 10 include the Liquid Corrosive Chemical Disposal Area (LCCDA), the Organic Moderated Reactor Experiment (OMRE), and former ordnance sites. (See Table 1-1 for additional information on each WAG.)

Operable Unit 10-01 is comprised of two disposal pits (LCCDA-01 and LCCDA-02) located in the southwest corner of the INEEL, approximately 1 km (0.6 mi) east of the main RWMC entrance. The LCCDA pits were used primarily for disposal of solid disposal and liquid corrosive chemicals such as nitric acid, sulfuric acid, and sodium hydroxide. A solitary disposal request uncovered as part of the Track 2 investigation suggested that some organics may have been disposed to LCCDA although sample results from the same investigation indicated that no SVOCs or VOCs are present.

Operable Unit 10-02 comprises the OMRE-1 leach pond. The OMRE was a 12-MW thermal reactor that was operated between 1957 and 1963, located in the southern portion of the INEEL approximately 6.25 km (2 mi) east of CFA. The reactor coolant consisted primarily of high-boiling-point organic compounds similar to wax; however, neutron bombardment degraded some compounds to low boiling point organics, including VOCs and SVOCs. Decomposition waste removed during periodic purification was not discharged to the pond, but large quantities of radioactive wastewater, possibly contaminated with organic coolant and decomposition wastes, were discharged to the pond.

Operable Unit 10-03 comprises all ordnance sites including OU 10-05 sites at the INEEL that are known or suspected to be contaminated with unexploded ordnance and high explosive residue from activities associated with the former Naval Proving Ground.

An interim action (OU 10-05) on six ordnance sites was performed in 1993. The six sites included the CFA gravel pit (ORD-04), the explosive bunkers north of INTEC (ORD-07), the National Oceanic and Atmospheric Administration (NOAA) grid (ORD-08), the CFA-633 area (ORD-03), the Fire Station II area (ORD-10), and the Anaconda Power Line (ORD-11) road. The goals of the interim action were to remove unexploded ordnance (UXO) and ordnance explosive waste to a depth of 0.61 m (2 ft) at each site and to remediate soils containing greater than 44 ppm for trinitrotoluene (TNT) or greater than 18 ppm for cyclotrimethylene trinitroamine (Research Development Explosive [RDX]). Approximately 185 yd^3 (686 drums) of explosive contaminated soil were excavated and sent off-Site for incineration. No UXO or ordnance explosive waste was encountered at this time at the CFA gravel pit or the explosive storage bunkers.

Table 1-1. References for problem description/background for each WAG.

WAG	Reference
1	INEL, 1994, Remedial Investigation Final Report, EGG-ER-10643, Rev. 0, January 1994.
1	DOE-ID, 1997, *Comprehensive Remedial Investigation/Feasibility Study for Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* DOE/ID-10557, Rev. 0, November 1997.
1	INEL, 1992, *Remedial Investigation/Feasibility Study Work Plan and Addenda for the Test Area North Groundwater Operable Unit at the Idaho National Engineering Laboratory*, EGG-WM-9905, Rev. 0, May 1992.
2	DOE-ID, 1997, *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory,* DOE/ID-10531, Rev. 0, February 1997.
2	INEL, 1992, Remedial Investigation Report for Test Reactor Area Perched Water System (Operable Unit 2-12), EGG-WM-10002, Rev. 0, June 1992.
3	DOE-ID, 1997, *Comprehensive Remedial Investigation/Feasibility Study (RI/FS) for ICPP OU 3-13 Part A—Remedial Investigation Baseline Risk Assessment (R/BRA) Report,* DOE/ID-10534, Rev. 0, November 1997.
4	DOE-ID, 1999, *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory,* DOE/ID-10680, Rev. 1, July 2000.
4	INEL, 1995, *Remedial Investigation Feasibility Study (RI/FS) For OU 4-12: CFA Landfill I, Landfill II, Landfill III At The INEL, Volume I Remedial Investigation (RI)," and "Remedial Investigation Feasibility Study (RI/FS) For OU 4-12: CFA Landfill I, Landfill II, Landfill III At The INEL, Volume II Feasibility Study (FS),* INEL-94/0124, February 1995.
5	DOE-ID, 1999, *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study,* DOE/ID-10607, Rev. 0, January 1999.
6	DOE-ID, 1999, *Work Plan for Waste Area Groups 6 and 10 Operable Unit 10-04 Comprehensive Remedial Investigation/Feasibility Study,* DOE/ID-10554, Rev. 0, April 1999.
7	DOE-ID, 1994, *Record of Decision: Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area,* U.S. Department of Energy, Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, January 1994.
7	DOE-ID, 1994, *Record of Decision: Declaration for Organic Contamination in the Vadose Zone Operable Unit 7-08*, U.S. Department of Energy, Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, November 1994.
7	DOE-ID, 1995, *Remedial Action Report Pad A Limited Action, Operable Unit 7-12,* INEL-95/0313, Rev. 2, July 1995.
7	DOE-ID, 1995, *Final Remedial Design/Remedial Action Workplan, Organic Contamination in Vadose Zone, Operable Unit 7-08, Radioactive Waste Management Complex Subsurface Disposal Area,* SCIE-COM-200-95, Rev. 0, October 1995.
7	INEL, 1996, *Work Plan for Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study,* INEL-95/0343, Rev. 0, May 1996.
7	DOE-ID, 1998, *Addendum to the Work Plan for the Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study,* DOE/ID-10622, Rev. 0, August 1998.
7	DOE-ID, 1999, *Work Plan for Stage I of the Operable Unit 7-10 Staged Interim Action,* DOE/ID-10623, *Rev. 1,* September 1999.

Operable Unit 10-04 includes the Security Training Facility (STF)-601 sumps and pits and the STF gun range. The sumps and pits are located in Building 601 basement and surrounding area. The sumps and pits contain water, and based on high water marks the levels have fluctuated. The fluctuation is likely caused by precipitation entering through the roof and exiting through the basement. The gun range was used for several years by the security force for small caliber handguns. Approximately 4 to 5 million rounds were fired into the berm. Most rounds were confined to the north berm, but scattered lead is apparent in outlying areas. The berm is approximately 3 to 3.7-m (10 to 12-ft) high, 6.1 to 7.6-m (20 to 25-ft) wide at the bottom, and 3-m (6-ft) wide at the top. The side berms (east and west) are approximately 61-m (200-ft) long and the north berm is approximately 76-m (250-ft) long.

Operable Unit 10-05 consisted of an interim action for unexploded ordnance at six sites. These six sites are included as a subset of OU 10-03, which includes all ordnance areas located at the INEEL including Naval Ordnance Disposal Area (NODA).

Operable Unit 10-06 (newly identified site) is comprised of miscellaneous radionuclide-contaminated soil areas and areas of windblown contamination.

Operable Unit 10-07 (newly identified site) consists of a buried telecommunications cable installed in the early 1950s. The cable, approximately 5 cm (2 in.) in diameter, consists of copper wiring with paper insulation enclosed by a 0.32-cm (1/8-in.) thick lead sheathing wrapped in spiraled steel, and enclosed in jute wrapping impregnated with an asphalt-like substance. The cable is buried approximately 0.9 to 1.2-m (3 to 4-ft) deep parallel to and approximately 91 m (100 yd) east of Lincoln Boulevard on the INEEL. The cable originates at CFA and runs along Lincoln Boulevard to TAN. U.S. West Communications cut the cable in the spring of 1990 to render it useless.

Operable Unit 10-08 includes the SRPA and newly identified sites.

1.2.3 Overview of Deactivation, Decontamination, and Decommissioning

The Inactive Sites Department of the Environmental Restoration Directorate is responsible for administration of the INEEL D&D&D Program. The INEEL D&D&D Program currently involves inactive, radiologically contaminated DOE-ID facilities managed by the INEEL contractor. The facilities have been declared surplus and have been deactivated. Deactivation involves placing a facility in a safe and stable condition to minimize long-term surveillance, maintenance, and environmental impacts.

The D&D&D Program includes surplus facilities located at TAN, TRA, INTEC, CFA, PBF, ARA, STF, RWMC, and the experimental areas located near the RWMC. Areas assigned to Argonne National Laboratory-West and the Naval Reactors Facility are excluded from the program.

The D&D&D process involves radiological surveys and chemical sampling and analysis to characterize the facility. It also involves planning and preparation of safety and characterization documentation that includes a decision analysis to determine the preferred mode for D&D&D, and a D&D&D plan for the facility dismantlement activities resulting in the released site followed by a final project report.

All D&D&D activities involving data collection and analysis are conducted in accordance with this QAPjP.

1.2.4 Site-Specific Information

Site-specific information, including a site map for each project using this QAPjP, will be included in the site background section of the project-specific FSP or other appropriate documentation (e.g., test plan, RD/RA work plans).

1.3 Project Plans

This section provides a background of the projects and the types of activities to be conducted, including the measurements that may be taken and the associated QA/QC goals, procedures, and timetables for collecting the measurements. Project-specific documents will list the QA/QC goals, procedures, and timetables for collecting the measurements. The discussion in this QAPjP is limited to the generic types of activities that might occur at any CERCLA OU, goals, procedures, and measurements. The generic timetable is provided by the FFA/CO Action Plan. A brief description of a RI/FS and D&D&D activity is used for an example. The present RI/FS work plans are provided in Table 1-1 for reference. Additional information will be found in individual RODs when approved.

1.3.1 Remedial Investigation/Feasibility Studies and D&D&D Plans

The environmental problems and background associated with each facility are addressed in the individual RI/FS work plans, RD/RA work plans, RODs, D&D&D plans, FSP, O&M plans, and associated environmental documentation. In general, those problems include low-level radiological contamination, asbestos, lead, metals, inorganic and organic contamination, and fugitive dusts. For specific problems and background see the project-specific plans.

A variety of measurements are necessary during any field activity at one of the OUs. Typical measurements may include radiological screening for contamination, using field instrumentation and possibly radiochemistry analyses of samples collected at a laboratory. Other necessary measurements may include vapor badge analyses for worker safety, organic and inorganic analyses of collected samples, using field instruments to check for absence or presence of organics, and visual examinations of the soils.

Other measurements likely during different processes under CERCLA are physical properties of soils, sludge, and debris. Those measurements might be field tests or require the use of an analytical laboratory, depending on the DQOs. The test/analytical methods are listed and discussed in Section 2 of this QAPjP. Project-specific FSPs, Test Plans, and other work controlling documents provide the tests and analyses required for that activity.

Applicable technical quality standards or criteria are defined during the CERCLA processes using applicable or relevant and appropriate requirements (ARARs). Records of Decision and other primary and secondary FFA/CO documents define the regulatory framework associated with the individual or group of OUs. The DQO action levels may be included as ARARs.

Any special equipment or personnel requirements will be specified in the FSPs, RD/RA work plan, D&D plans, or other work-authorizing documents. Special personnel requirements usually involve additional training and qualification requirements. Specialized equipment may be needed during any FFA/CO process. Those specialized needs will be addressed by the project-specific documentation and translated to procurement specifications to obtain the equipment. Specialized equipment may include confinement enclosures, remote-handling equipment, or refined field instrumentation.

The degree of quality assurance assessment activity for any project will depend on the complexity, duration, and objectives of that project. The FSP, test plan, or other work-controlling documents will

specify the minimum assessment activity requirements. As a general rule of thumb, one quality assurance assessment should be done at each project. The exception to the rule is D&D&D projects, where the D&D&D project manager requests the assessment, if deemed necessary. In addition to quality assurance assessments, the field team leader (FTL) completes an FTL checklist at the start of each field activity. The checklist is used to evaluate team preparedness to start a sampling activity. Similar preparedness reviews are done for D&D&D, RI, and post-ROD projects.

Records generated during all CERCLA and D&D processes are retained using an Optical Imaging System (OIS). Typical records include the RODs, FSPs, RI/FS work plans, RD/RA work plan, RI report, summary reports, limitation and validation reports, risk assessments, community relations plans, and other documents discussed in the FFA/CO Section XX, "Retention of Records and Administrative Record."

1.3.2 Schedule

The work schedule for all WAG 1, 2, 3, 4, 5, 6, 7, and 10 activities is outlined in the Action Plan (INEEL 1991b, Appendix A). Project-specific schedules are included in the individual Scopes of Work, which are prepared jointly by the project managers.

1.4 Guidance for the Data Quality Objectives Process

Data Quality Objectives are qualitative and quantitative terms used to define the requirements for data collected during an environmental investigation or remediation. The DQO development process is mandatory systematic planning used to establish which data are required and to determine the performance criteria for the measurement system that will be used in generating the data. EPA QA/G-4, *Guidance for the Data Collection Process* (EPA 1994), provides guidance on developing DQOs. Specific DQOs are stated and discussed in detail in the applicable FSP, test plans, and work plans.

The seven steps, with a brief explanation of each, are as follows:

1. State the problem. Concisely describe the problem to be studied. Review prior studies and existing information to gain an acceptable understanding of the problem.

2. Identify the decision. Using new data, identify the decision that will solve the problem.

3. Identify the inputs to the decision. Identify the information that needs to be learned and the measurements that need to be taken in order to resolve the decision.

4. Define the study boundaries. Specify the conditions (time periods and situations) to which decisions will apply and within which the data should be collected.

5. Develop a decision rule. Integrate the outputs from previous steps into an "if…then" statement that defines the conditions that would cause the decision-maker to choose among alternative actions.

6. Specify acceptable limits on decision errors. Define the decision-maker's acceptable decision error rates based on a consideration of the consequences of making an incorrect decision. A decision error rate is the probability of making an incorrect decision based on data that inaccurately estimate the true state of nature (EPA 1994).

7. Optimize the design. Evaluate information from the previous steps and generate alternative sampling designs. Choose the most resource-efficient design that meets all DQOs.

1.4.1 Project Quality Objectives

Quality assurance (QA) objectives are specifications that measurements must meet to produce acceptable data for the project. The technical and statistical qualities of those measurements must be properly documented. Precision, accuracy, method detection limits, and completeness must be specified for physical/chemical measurements. Additional analytical requirements are described qualitatively in terms of representativeness and comparability. The QA objectives are needed for all critical measurements and for each type of sample matrix (EPA 1991a, Page 17). This QAPjP is designed to cover a wide variety of sampling activities. In many cases the statistical analyses required to evaluate the QA objectives may not be appropriate for a limited data set produced during some investigations. Therefore, QA objectives specified throughout this section are assumed to meet project objectives and DQOs, unless otherwise specified in the project-specific FSP, test plan, or work plan, and are applicable to mobile and on- and off-Site fixed laboratories. A discussion of whether the DQOs of the project have been met and the impacts on the decision process will be included in the project report (RI report, summary report, remedial action [RA] reports, for example). Some field measurements (for example, down hole logging and in situ gamma measurements) are neither screening nor definitive as defined herein. Not all QA/QC elements are attainable. For those data, QA/QC requirements are established in the individual work documents.

1.4.2 Analytical Data Categories

The EPA has defined two analytical data categories that correspond to data uses, primarily through the decision-maker's acceptable limits on decision errors (EPA 1993b, Pages 42-44). The project-specific FSP or test plan will designate the data categories of the analyses to be conducted for that project. The two Superfund data categories are

- Screening data with definitive confirmation
- Definitive data.

The two data categories are associated with specific quality assurance and quality control elements and may be generated using a wide range of analytical methods. The particular type of data to be generated depends on the qualitative and quantitative DQOs developed during application of the DQO process. The decision on the type of data to be collected should not be made until Step 7 of the DQO process. The EPA definitions give no allowance for testing geological properties, widely used in RD/RA activities. Therefore, the definitions below have been expanded from the EPA definitions to include allowances for these data and their potential use and inclusion as definitive data.

1.4.3 Screening Data with Definitive Confirmation

1.4.3.1 Definition of Screening Data. Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures, such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data provide analyte or property identification and quantification, although the quantification may be relatively imprecise. The EPA definition states that at least 10 % of the screening data are confirmed using analytical method and QA/QC procedures and criteria associated with definitive data. It further states that screening data without associated confirmation data are not considered to be data of known quality. There are cases where it may be appropriate for ER projects to collect screening data with no associated confirmation data. As the technology for field analytical determinations advances, it is likely that data that would meet the definition of screening data could be considered data of known quality. Another example is when a project's objectives are less likely to be associated with a potential

enforcement action (e.g., a research project). The FSPs prepared for individual projects will specify if confirmatory definitive data will be produced when screening data are used for the project.

1.4.3.2 Screening Data QA/QC Elements

- Sample documentation (for example, location, date and time collected, batch).
- Chain of custody (when appropriate).
- Sampling design approach (for example, systematic, simple or stratified random, judgmental).
- Initial and continuing calibration (when applicable).
- Determination and documentation of detection limits.
- Analyte(s) or property identification.
- Analyte(s) or property quantification.
- Analytical error determination:[a] An appropriate number of replicate aliquots, as specified in the FSP, are taken from at least one thoroughly homogenized sample, the replicate aliquots are analyzed, and standard laboratory quality control (QC) parameters (such as variance, mean, and coefficient of variance) are calculated and compared to method-specific performance requirements specified in the FSP.
- Definitive confirmation: The EPA definition states that at least 10 % of the screening data must be confirmed with definitive data as described below. At least three screening samples reported above the action level, if any, and three screening samples reported below the action level (or as nondetects [NDs]) should be randomly selected from the appropriate group and confirmed. If definitive confirmation data will not be obtained and used as confirmation of the screening data collected for a project, the rationale behind this decision will be discussed in the FSP.

1.4.4 Definitive Data

1.4.4.1 Definition of Definitive Data. Definitive data are generated, using rigorous analytical methods, such as approved EPA or American Society for Testing and Materials (ASTM) reference methods or well-established and documented test methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated files. In the case of physical property measurements, where digital values are often not obtained from an instrument, analyst observations are documented in logbooks. Data may be generated at the site or at an off-Site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined.

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a. The procedures identified here measure the precision of the analytical method and are required when total measurement error is not determined under confirmation step.

1.4.4.2 Definitive Data QA/QC Elements

- Sample documentation (for example, location, date and time collected, batch).
- Chain of custody (when appropriate).
- Sampling design approach (for example, systematic, simple or stratified random, judgmental).
- Initial and continuing calibration (when applicable).
- Determination and documentation of detection limits.
- Analyte(s) or property identification.
- Analyte(s) or property quantification.
- QC blanks (trip, method, rinsate) when applicable and as stated in this QAPjP.
- Matrix spike recoveries (when applicable to the analytical method).
- Performance evaluation (PE) samples (per Section 1.4.5.2.1 of this document).
- Analytical error determination (measures precision of analytical method): A predetermined number of replicate aliquots, as specified in the analytical method, Statement of Work (SOW) to the laboratory, or FSP, are taken from at least one appropriately subsampled sample. The replicate aliquots are analyzed, and standard laboratory QC parameters (such as variance, mean, and coefficient of variation) are calculated and compared to method-specific performance requirements defined in the SOW to the laboratory, the analytical method, FSP, or this QAPjP.
- Total measurement error determination (measures overall precision of measurement system, from sample acquisition through analysis): An appropriate number of collocated samples as determined by the FSP, using Table 2-1 as guidance, are independently collected from the same location and analyzed following standard operating procedures. Based on those analytical results, standard laboratory QC parameters such as variance, mean, and coefficient of variation should be calculated and compared to established measurement error goals. That procedure may be required for each matrix under investigation and may be repeated for a given matrix at more than one location at the site.

1.4.5 Impact of Data Categories on Existing Superfund Guidance

The data categories identified in Section 1.4.2 of this QAPjP replace references to analytical levels, quality assurance objectives, and data use categories. The major documents impacted by the data categories are

- *Data Quality Objective Guidance for Remedial Response Activities: Development Process and Case Studies*, EPA/540/G-87/003 and 004, OSWER Directive 9355.7B
- *Quality Assurance/Quality Control Guidance for Removal Activities: Sampling QA/QC Plan and Data Validation Procedures*, EPA/540/G-90/004, OSWER Directive 9360.4-01, April 1990

- *Guidance for Performing Site Inspections Under CERCLA*, OSWER Directive 9345.1-05, November 1992.

The quantitative QA parameters are precision, accuracy, and completeness. The qualitative QA parameters are comparability and representativeness.

1.4.5.1 Precision. Precision is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions (EPA 1998a, Page D-1). This agreement is calculated as either relative percent difference (RPD) for two measurements or relative standard deviation (RSD) for three or more measurements. The formulas for calculating RPD and RSD are in Subsection 4.3 of this QAPjP.

1.4.5.1.1 Laboratory Precision—Laboratory precision will be calculated as defined in Subsection 4.3.2.1 of this QAPjP. When the EPA Contract Laboratory Program (CLP) methods are used for organic analyses, precision goals for the analytes that have EPA established precision criteria will be within those provided in the CLP Statement of Work (EPA 1999). Those criteria are listed in Tables 1-2, 1-3, and 1-4. When other organic analysis methods are used, precision goals will be established consistent with the method's published criteria for precision data (when available). Precision goals have been established for inorganic CLP methods by the EPA (EPA 1993a) and for radiological analyses in the Sample Management Office (SMO) technical procedure.

1.4.5.1.2 Field Precision—Field precision is a measure of the variability not due to laboratory or analytical methods. Three sources of field variability or heterogeneity are spatial (population) and between-samples and within-sample heterogeneity (Harris 1990, Section 6.1, Pages 1-5). Although the between-sample, and within-sample heterogeneity can be evaluated individually using duplicate and split samples, overall field precision will be calculated as the RPD or RSD of field duplicates as defined in Subsection 2.3 of this QAPjP. Given the number of duplicate and/or split samples collected and the confidence level required, an estimate of the precision may be developed. A project's required confidence levels should be documented when deviating from the frequencies specified in Table 1-5.

1.4.5.2 Accuracy. Accuracy is a measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that result from sampling and analytical operations (EPA 1998a, Page D-2).

1.4.5.2.1 Laboratory Accuracy—The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for those analytical methods on similar sample matrices (INEL 1995a). Tables 1-2, 1-3, and 1-4 reflect the matrix spike (MS) percent recovery (%R) control limits for organic analyses, as defined by the EPA CLP SOW (EPA 1999). The MS recovery, i.e., laboratory accuracy for organic analyses, must be within those control limits or the data flagged and data use evaluated. No action is taken on matrix spike/matrix spike duplicate (MS/MSD) data alone. However, during data review the MS and MSD results may be used in conjunction with other QC criteria for the determination of the need to qualify the data. Subsequent use of flagged data should be evaluated.

Laboratory accuracy for inorganic and miscellaneous classical analyses (I&MCA) data is assessed through the use of one or more of three possible QC elements (i.e., laboratory control sample [LCS], MS, sample, and PE sample). The control limits for LCS and MS samples vary depending on test conditions (e.g., sample matrix and analysis method) and are thus not listed in this QAPjP. They are defined in the I&MCA Master Test Agreement (MTA) SOW (INEL 1995c). The PE samples have certified control limits established by their associated vendors.

Table 1-2. CLP volatile organic target compound list.

Compound	CAS[a] Number	CRQL Water (µg/L)	CRQL Low Soil (µg/kg)	CRQL Med Soil[b] (µg/kg)	QC Limits Water %R	QC Limits Water RPD	QC Limits Soil %R	QC Limits Soil RPD
Acetone	67-64-1	10	10	1,300	—	—	—	—
Benzene[c,d]	71-43-2	10	10	1,300	76-127	11	66-142	21
Bromodichloromethane[d]	75-27-4	10	10	1,300	—	—	—	—
Bromoform[d]	75-25-2	10	10	1,300	—	—	—	—
Bromomethane[d]	74-83-9	10	10	1,300	—	—	—	—
2-butanone	78-93-3	10	10	1,300	—	—	—	—
Carbon disulfide	75-15-0	10	10	1,300	—	—	—	—
Carbon tetrachloride[c,d]	56-23-5	10	10	1,300	—	—	—	—
Chlorobenzene[c]	108-90-7	10	10	1,300	75-130	13	60-133	21
Chloroethane	75-00-3	10	10	1,300	—	—	—	—
Chloroform[c]	67-66-3	10	10	1,300	—	—	—	—
Chloromethane[c]	074-87-3	10	10	1,300	—	—	—	—
Cis-1,2-dichloroethene	156-59-2	10	10	1,300	—	—	—	—
Cis-1,3-dichloropropene[d,e]	10061-01-5	10	10	1,300	—	—	—	—
Cyclohexane	110-82-7	10	10	1,300	—	—	—	—
Dibromochloromethane[d]	124-48-1	10	10	1,300	—	—	—	—
1,2-dibromo-3-chloropropane	96-12-8	10	10	1,300	—	—	—	—
1,2-dibromoethane	106-93-4	10	10	1,300	—	—	—	—
1,2-dichlorobenzene	95-50-1	10	10	1,300	—	—	—	—
1,3-dichlorobenzene	541-73-1	10	10	1,300	—	—	—	—
1,4-dichlorobenzene	106-46-7	10	10	1,300	—	—	—	—
Dichlorodifloromethane	75-71-8	10	10	1,300	—	—	—	—
1,1-dichloroethane	75-34-3	10	10	1,300	—	—	—	—
1,2-dichloroethane[c,d]	107-06-2	10	10	1,300	—	—	—	—
1,1-dichloroethene[c,d,e]	75-35-4	10	10	1,300	61-145	14	59-172	22
1,2-dichloroethene (total)[b,c]	540-59-0	10	10	1,300	—	—	—	—
1,2-dichloropropane[c,d]	78-87-5	10	10	1,300	—	—	—	—
Ethylbenzene	100-41-4	10	10	1,300	—	—	—	—
2-Hexanone	591-78-6	10	10	1,300	—	—	—	—
Isopropylbenzen	98-82-8	10	10	1,300	—	—	—	—
4-methyl-2-pentanone	108-10-1	10	10	1,300	—	—	—	—

Table 1-2. (continued).

Compound	CAS[a] Number	CRQL Water (µg/L)	CRQL Low Soil (µg/kg)	CRQL Med Soil[b] (µg/kg)	QC Limits Water %R	QC Limits Water RPD	QC Limits Soil %R	QC Limits Soil RPD
Methyl acetate	79-20-9	10	10	1,300	—	—	—	—
Methylcyclohexane	108-87-2	10	10	1,300	—	—	—	—
Methylene chloride[c,d]	75-09-2	10	10	1,300	—	—	—	—
Methyl tert-butyl ether	1634-04-4	10	10	1,300	—	—	—	—
Styrene	100-42-5	10	10	1,300	—	—	—	—
1,1,2,2-tetrachloroethane[d]	79-34-5	10	10	1,300	—	—	—	—
Tetrachloroethene[c,d]	127-18-4	10	10	1,300	—	—	—	—
Toluene	108-88-3	10	10	1,300	76-125	13	59-139	21
Trans-1,2-dichloroethene	156-60-5	10	10	1,300	—	—	—	—
Trans-1,3-dichloropropene[c,d]	10061-02-6	10	10	1,300	—	—	—	—
1,2,4-Trichlorobenzene	120-82-1	10	10	1,300	—	—	—	—
1,1,1-trichloroethane	71-55-6	10	10	1300	—	—	—	—
1,1,2-trichloroethane[c,d]	79-00-5	10	10	1,300	—	—	—	—
Trichloroethene[c,d]	79-01-6	10	10	1,300	71-120	14	62-137	24
Trichlorofluoromethane	75-69-4	10	10	1,300	—	—	—	—
1,1,2-trichloro-1,1,2-trifluoroethane	76-13-1	10	10	1,300	—	—	—	—
Vinyl chloride[c,d,e]	75-01-4	10	10	1,300	—	—	—	—
Xylene (total)[c]	1330-20-7	10	10	1,300	—	—	—	—

a. CAS = Chemical Abstract Service.

b.The term "medium soil" refers to contaminant concentrations in the soil. The CLP method includes a preanalysis screening protocol where samples screened with volatile organic analytes at >2,000 µg/kg are analyzed using the medium-level protocol. The medium-level protocol has an elevated contract-required quantification limit (CRQL) as indicated by the table. Information known about samples that will be close to, or exceed, the 2,000-µg/kg level should be provided to the SMO during laboratory acquisition and to the laboratory on chain-of-custody forms sent with the samples.

b. This compound is regulated under the National Primary Drinking Water Regulations and one tenth of the MCL is less than the listed CRQL for water samples. When MCLs are a project ARAR, the CLP method should not be used for water samples. When lower detection limits are required for water samples, they must be analyzed using EPA Method 8260B with a 25-mL purge volume or EPA Method 524.2 (see Table 1-8).

c. The water sample CRQL listed for this compound is greater than one tenth of the 10^{-6} risk-based screening level for tap water as specified in the EPA Region IX preliminary remedial goals (PRGs). When lower detection limits are required for water samples, they must be analyzed using EPA Method 8260B with a 25-mL purge volume or EPA Method 524.2 (see Table 1-8).

d. The low soil sample CRQL listed for this compound is greater than one tenth of the 10^{-6} risk-based screening level for residential soil as specified in the EPA Region IX PRGs. When lower detection limits are required for soil samples, contact SMO personnel to discuss alternative methods.

Table 1-3. CLP semivolatile organic target compound list.

Compound	CAS Number	CRQL[a] Water (µg/L)	CRQL[a] Low Soil (µg/kg)	CRQL[a] Med Soil (µg/kg)	QC Limits Water %R	QC Limits Water RPD	QC Limits Soil %R	QC Limits Soil RPD
Acenaphthene	83-32-9	10	330	10,000	46-118	31	31-137	19
Acenaphthylene	208-96-8	10	330	10,000	—	—	—	—
Acetophenone	98-86-2	10	330	10,000	—	—	—	—
Anthracene	120-12-7	10	330	10,000	—	—	—	—
Atrazine	1912-24-9	10	330	10,000	—	—	—	—
Benzaldehyde	100-52-7	10	330	10,000	—	—	—	—
Benzo(a)anthracene[c,d]	56-55-3	10	330	10,000	—	—	—	—
Benzo(b)fluoranthene[c,d]	205-99-2	10	330	10,000	—	—	—	—
Benzo(k)fluoranthene[c]	207-08-9	10	330	10,000	—	—	—	—
Benzo(g,h,i)perylene	191-24-2	10	330	10,000	—	—	—	—
Benzo(a)pyrene[b,c,d]	50-32-8	10	330	10,000	—	—	—	—
1,1'-biphenyl	92-52-4	10	330	10,000	—	—	—	—
bis(2-chloroethyl)ether[c,d]	111-44-4	10	330	10,000	—	—	—	—
bis(2-chloroethoxy)methane	111-91-1	10	330	10,000	—	—	—	—
bis(2-ethylhexyl)phthalate[c,d]	117-81-7	10	330	10,000	—	—	—	—
4-bromophenyl-phenylether	101-55-3	10	330	10,000	—	—	—	—
Butylbenzylphthalate	85-68-7	10	330	10,000	—	—	—	—
Carbazole[c]	86-74-8	10	330	10,000	—	—	—	—
Caprolactam	105-60-2	10	330	10,000	—	—	—	—
4-chloroaniline	106-47-8	10	330	10,000	—	—	—	—
4-chloro-3-methylphenol	59-50-7	10	330	10,000	23-97	42	26-103	33
2-chloronaphthalene	91-58-7	10	330	10,000	—	—	—	—
2-chlorophenol[c]	95-57-8	10	330	10,000	27-123	40	25-102	50
4-chlorophenyl-phenylether	7005-72-3	10	330	10,000	—	—	—	—
Chrysene[c]	218-01-9	10	330	10,000	—	—	—	—
Dibenz(a,h)anthracene[c,d]	53-70-3	10	330	10,000	—	—	—	—
Dibenzofuran[c]	132-64-9	10	330	10,000	—	—	—	—
1,2-dichlorobenzene[b]	95-50-1	10	330	10,000	—	—	—	—
1,3-dichlorobenzene[d]	541-73-1	10	330	10,000	—	—	—	—
1,4-dichlorobenzene[b,c,d]	106-46-7	10	330	10,000	36-97	28	28-104	27
3,3'-dichlorobenzidine[c,d]	91-94-1	10	330	10,000	—	—	—	—
2,4-dichlorophenol	120-83-2	10	330	10,000	—	—	—	—
Diethylphthalate	84-66-2	10	330	10,000	—	—	—	—

Table 1-3. (continued).

Compound	CAS Number	CRQL[a] Water (µg/L)	CRQL[a] Low Soil (µg/kg)	CRQL[a] Med Soil (µg/kg)	QC Limits Water %R	QC Limits Water RPD	QC Limits Soil %R	QC Limits Soil RPD
2,4-dimethylphenol	105-67-9	10	330	10,000	—	—	—	—
Dimethylphthalate	131-11-3	10	330	10,000	—	—	—	—
Di-n-butylphthalate	84-74-2	10	330	10,000	—	—	—	—
Di-n-octylphthalate	117-84-0	10	330	10,000	—	—	—	—
2,4-dinitrophenol[c]	51-28-5	25	830	25,000	—	—	—	—
4,6-dinitro-2-methylphenol	534-52-1	25	830	25,000	—	—	—	—
2,4-dinitrotoluene[c]	121-14-2	10	330	10,000	24-96	38	28-89	47
2,6-dinitrotoluene[c]	606-20-2	10	330	10,000	—	—	—	—
Fluoranthene	206-44-0	10	330	10,000	—	—	—	—
Fluorene	86-73-7	10	330	10,000	—	—	—	—
Hexachlorobenzene[b]	118-74-1	10	330	10,000	—	—	—	—
Hexachlorobutadiene[c]	87-68-3	10	330	10,000	—	—	—	—
Hexachloroethane[c]	67-72-1	10	330	10,000	—	—	—	—
Hexachlorocyclopentadiene[b]	77-47-4	10	330	10,000	—	—	—	—
Indeno(1,2,3-cd)pyrene[c,d]	193-39-5	10	330	10,000	—	—	—	—
Isophorone[c]	78-59-1	10	330	10,000	—	—	—	—
2-methylnaphthalene	91-57-6	10	330	10,000	—	—	—	—
2-methylphenol	95-48-7	10	330	10,000	—	—	—	—
4-methylphenol	106-44-5	10	330	10,000	—	—	—	—
N-nitroso-di-n-propylamine[c,d]	621-64-7	10	330	10,000	41-116	38	41-126	38
N-nitrosodiphenylamine[c]	86-30-6	10	330	10,000	—	—	—	—
Naphthalene[c,d]	91-20-3	10	330	10,000	—	—	—	—
2-nitroaniline[c,d]	88-74-4	25	830	25,000	—	—	—	—
3-nitroaniline	99-09-2	25	830	25,000	—	—	—	—
4-nitroanaline	100-01-6	25	830	25,000	—	—	—	—
Nitrobenzene[c]	98-95-3	10	330	10,000	—	—	—	—
2-nitrophenol	88-75-5	10	330	10,000	—	—	—	—
4-nitrophenol	100-02-7	25	830	25,000	10-80	50	11-114	50
2,2'oxybis(1-chloropropane)[c]	108-60-1	10	330	10,000	—	—	—	—
Pentachlorophenol[b,c,d]	87-86-5	25	830	25,000	9-103	50	17-109	47
Phenanthrene	85-01-8	10	330	10,000	—	—	—	—
Phenol	108-95-2	10	330	10,000	12-110	42	26-90	35

Table 1-3. (continued).

Compound	CAS Number	CRQL[a] Water (µg/L)	CRQL[a] Low Soil (µg/kg)	CRQL[a] Med Soil (µg/kg)	QC Limits Water %R	QC Limits Water RPD	QC Limits Soil %R	QC Limits Soil RPD
Pyrene	129-00-0	10	330	10,000	26-127	31	35-142	36
1,2,4-trichlorobenzene[b]	120-82-1	10	330	10,000	39-98	28	38-107	23
2,4,5-trichlorophenol	95-95-4	25	830	25,000	—	—	—	—
2,4,6-trichlorophenol[c]	88-06-2	10	330	10,000	—	—	—	—

a. The term "medium soil" refers to contaminant concentrations in the soil. The CLP method includes a pre-analysis screening protocol where samples screened with semivolatile organic analytes at >10,000 µg/kg are analyzed using the medium level protocol. The medium level protocol has an elevated CRQL as indicated on the table. Information known about samples that will be close to, or exceed, the 10,000 µg/kg level should be provided to the SMO during laboratory acquisition and to the laboratory on chain-of-custody forms sent with the samples.

b. This compound is regulated under the National Primary Drinking Water Regulations and one tenth of the MCL is less than the listed CRQL for water samples. When MCLs are a project ARAR, the CLP method should not be used for water samples. When lower detection limits are required for water samples, they must be analyzed using an appropriate EPA method (e.g., Method 525.2).

c. The water sample CRQL listed for this compound is greater than one tenth of the 10^{-6} risk-based screening level for tap water as specified in the EPA Region IX PRGs. When lower detection limits are required for water samples, they must be analyzed using an appropriate EPA method (e.g., Method 525.2).

d. The low soil sample CRQL listed for this compound is greater than one tenth of the 10^{-6} risk-based screening level for residential soil as specified in the EPA Region IX PRGs. When lower detection limits are required for soil samples, contact SMO personnel to discuss alternative methods.

Table 1-4. CLP pesticide organic target compound list.

Compound	CAS Number	CRQL Water (µg/L)	CRQL Soil (µg/kg)	QC Limits Water %R	QC Limits Water RPD	QC Limits Soil %R	QC Limits Soil RPD
Aldrin[b]	309-00-2	0.05	1.7	40-120	22	34-132	43
alpha-BHC[b]	319-84-6	0.05	1.7	—	—	—	—
alpha-Chlordane[b]	5103-71-9	0.05	1.7	—	—	—	—
Aroclor-1016[a]	12674-11-2	1.0	33.0	—	—	—	—
Aroclor-1221[a]	11104-28-2	2.0	67.0	—	—	—	—
Aroclor-1232[a]	11141-16-5	1.0	33.0	—	—	—	—
Aroclor-1242[a]	53469-21-6	1.0	33.0	—	—	—	—
Aroclor-1248[a]	12672-29-6	1.0	33.0	—	—	—	—
Aroclor-1254[a]	11097-69-1	1.0	33.0	—	—	—	—
Aroclor-1260[a]	11096-82-5	1.0	33.0	—	—	—	—
beta-BHC[b]	319-85-7	0.05	1.7	—	—	—	—
4,4'-DDD[b]	72-54-8	0.10	3.3	—	—	—	—
4,4'-DDE[b]	72-55-9	0.10	3.3	—	—	—	—
4,4'-DDT[b]	50-29-3	0.10	3.3	38-127	27	23-134	50
delta-BHC	319-86-8	0.05	1.7	—	—	—	—
Dieldrin[b,c]	60-57-1	0.10	3.3	52-126	18	31-134	38
Endosulfan I	959-98-8	0.05	1.7	—	—	—	—
Endosulfan II	33213-65-9	0.10	3.3	—	—	—	—
Endosulfan sulfate	1031-07-8	0.10	3.3	—	—	—	—
Endrin	72-20-8	0.10	3.3	56-121	21	42-139	45
Endrin aldehyde	7421-36-3	0.10	3.3	—	—	—	—
Endrin ketone	53494-70-5	0.10	3.3	—	—	—	—
gamma-BHC (Lindane)[a,b]	58-89-9	0.05	1.7	56-123	15	46-127	50
gamma-Chlordane[b]	5103-74-2	0.05	1.7	—	—	—	—
Heptachlor[a,b]	76-44-8	0.05	1.7	40-131	20	35-130	31
Heptachlor epoxide[a,b]	1024-57-3	0.05	1.7	—	—	—	—
Methyloxychlor[b,c]	72-43-5	0.50	17.0	—	—	—	—
Toxaphene[a,b,c]	8001-35-2	5.0	170.0	—	—	—	—

a. This compound is regulated under the National Primary Drinking Water Regulations and one tenth of the MCL is less than the listed CRQL for water samples. When MCLs are a project ARAR, the CLP method should not be used for water samples. When lower detection limits are required for water samples, they must be analyzed using an appropriate EPA method (e.g., Method 508 or 525.2).

b. The water sample CRQL listed for this compound is greater than one tenth of the 10^{-6} risk-based screening level for tap water as specified in the EPA Region IX PRGs. When lower detection limits are required for water samples, they must be analyzed using an appropriate EPA method (e.g., Method 508 or 525.2).

c. The soil sample CRQL listed for this compound is greater than one tenth of the 10^{-6} risk-based screening level for residential soil as specified in the EPA Region IX PRGs. When lower detection limits are required for soil samples, contact SMO personnel to discuss alternative methods.

Table 1-5. Recommended minimum field QC samples.[a,b,c,d,e]

Sample Type	Purpose	Collection	Documentation
Duplicate	Collocated sample collected to evaluate total measurement precision (cumulative precision error associated with field and laboratory operations)	**Water and Soil:** Duplicates collected at a minimum frequency of 1/20 environmental samples or 1/day/matrix, whichever is less.	Assign separate sample number
Field blank	Analyte-free water that is poured into a sample container at the sample collection site to check cross-contamination during sample collection and shipment[c]	**Water:** **VOCs:** The recommended minimum frequency is 1/20 environmental samples or 1/day whichever is less. **Metals:** The recommended minimum frequency is 1/20 environmental samples or 1/day whichever is less. **Radionuclides:** If sampling under windy conditions, the recommended minimum frequency is 1/20 environmental samples or 1/day, whichever is less. **Soil:** Field blanks are only recommended for sub-surface soils (>6 in.) collected for radionuclide analyses. The recommended minimum frequency is 1/20 environmental samples or 1/day whichever is less. A field blank should be analyzed for the same radiological constituents as the environmental sample.	Assign separate sample number
Trip blank	Organic-free water in a vial sent from the laboratory to accompany VOC water samples during sampling and shipment processes. This blank is used for checking for cross-contamination during sample handling, shipment, and storage[d]	**Soil:** Trip blanks are not recommended. **Water:** Trip blanks are only recommended for VOCs. The recommended minimum frequency is 1/VOC cooler. To minimize the number of trip blanks, every effort should be made to include all VOC samples in one cooler and to minimize the number of VOC collection days.	Assign separate sample number
Equipment rinsate blank	Sample obtained by rinsing sample collection equipment with analyte-free water,[d] following decontamination, to evaluate field decontamination procedures	Equipment blanks should be collected from the same equipment used to collect samples and should be analyzed for the same constituents. Equipment blanks are not required if dedicated or disposable equipment is used. The recommended minimum frequency is 1/day/matrix or 1/20 environmental samples whichever is less.	Assign separate sample number

a. The frequencies specified in this table are a recommended minimum. Consensus agreement between FFA/CO WAG managers prior to submittal of the sampling and analysis plan can be used to adjust collection frequencies (increase or decrease). Adjustment must be justified in the Sampling and Analysis Plan.

b. Source: EPA (1987b).

c. Source: EPA (1993c).

d. The water used for these blanks should be VOC analyte-free and can be obtained from a laboratory familiar with VOC analysis requirements. The SMO can arrange to supply the water if given 2 weeks notice prior to sampling. y

e. For other sample matrices (e.g., gas, waste, biota) no field QC samples are required.

Laboratory accuracy for radiological analysis is assessed (as applicable) through laboratory control samples, radiometric tracers/chemical carriers, and/or blind PE samples. Assessment of these parameters and associated control limits is described in the SMO technical procedure.

Laboratory analytical method QC samples are analyzed as required by the SMO master task subcontract SOWs and/or the project-specific Task Order Statement of Work (TOS). To help evaluate laboratory accuracy, the SMO uses the PE samples analyzed for nonradiological parameters.

Double blind and single blind PE samples are used as real-time tools to evaluate analytical discipline and method specific laboratory performance. Soil and water samples will be submitted blind to the analytical laboratories with batches of field samples so that they are processed simultaneously with the field samples in the laboratory. The recommended frequency of use for these materials is one per project per matrix or one per 40 field samples of like matrix, whichever is greater. Including PE samples in a sampling project is a project management decision; therefore the frequency of including PE samples in a project shall be included in the FSP.

PE samples submitted for inorganic, miscellaneous classical, and/or organic parameters are assessed as described in the Performance Evaluation Sample Program Plan, PLN-862, or per project specifications included in the FSP.

1.4.5.2.2 Field Accuracy—Sources of field inaccuracy are sampling preservation and handling, field contamination, and the sample matrix. The sampling locations and methods described in the project-specific FSP or test plan and Subsections 2.1, 2.2, and 2.3 of this QAPjP are designed to be representative of the media being sampled or focused on specific scientific objectives. Sampling accuracy may be assessed by evaluating the results of field, equipment rinsate, and/or trip blanks as described in Subsection 4.3. During the sampling for volatile organic compounds, some portion of the volatile components may be lost. Although EPA-approved methods will be used to minimize the loss (EPA 1991b, Pages 1–22), there is no easy way to measure that loss.

Contamination of the samples in the field or during shipping, by sources other than the contamination under investigation, would yield inaccurate results. Therefore, equipment, field, and/or trip blanks will be sent to the chemical and radiological laboratories for analysis to evaluate possible contamination. Recommendations for blanks are listed in Table 1-5. Project-specific types and numbers of equipment, field, and/or trip blanks will be identified in the site-specific FSP or test plan.

1.4.5.3 Completeness. Completeness is a measure of the number of samples collected and analyzed, expressed as a percentage of the number of samples planned to be collected and analyzed. Field sampling completeness is affected by such factors as equipment and instrument malfunctions and insufficient sample recovery. Analytical completeness is affected if a sample is not analyzed before its holding time expires, if a sample is damaged during handling, shipping, unpacking or storage, or if the laboratory data cannot be validated and the sample cannot be reanalyzed. The completeness goal for sampling activities is 90% for noncritical samples and 100% for critical samples. Critical samples are those samples required to achieve project objectives or limits on decision errors. Noncritical samples are for informational purposes only or needed to provide background information (EPA 1998a).

1.4.5.4 Representativeness. Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population parameter at a sampling point, or for a process condition or environmental condition (EPA 1998a, Page D-2). Representativeness, a qualitative term, should be evaluated to determine whether in situ and other measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the media and phenomena measured or studied. The representativeness criterion is best satisfied by confirming that sampling

locations are selected properly and a sufficient number of samples are collected to meet the confidence level required by the intended use of the data. Sampling locations will be documented in the project-specific FSP or test plan. In some cases, a nonstatistical approach will be used to collect samples, or nonrepresentative samples will be taken to meet specific scientific objectives, which will be documented in the project-specific FSP or test plan.

1.4.5.5 Comparability. Comparability is the qualitative term that expresses the confidence that two data sets can contribute to a common analysis and interpolation. Comparability must be carefully evaluated to establish whether two data sets can be considered equivalent in regard to the measurement of a specific variable or groups of variables. In a laboratory analysis, the term comparability focuses on method type comparison, holding times, stability issues, and aspects of overall analytical quantitation.

A number of issues can make two data sets comparable, and the presence of each of the following items enhances their comparability:

- Two data sets should contain the same set of variables of interest.
- Units in which these variables were measured should be convertible to a common metric.
- Similar analytical procedures and quality assurance should be used to collect data for both data sets.
- Time of measurements of certain characteristics (variables) should be similar for both data sets.
- Measuring devices used for both data sets should have approximately similar detection levels.
- Rules for excluding certain types of observations from both samples should be similar.
- Samples within data sets should be selected in a similar manner.
- Sampling frames from which the samples were selected should be similar.
- The number of observations in both data sets should be of the same order or magnitude.

These characteristics vary in importance depending on the final use of the data. The closer two data sets are with regard to these characteristics, the more appropriate it will be to compare them. Large differences between characteristics may be of only minor importance, depending on the decision that is to be made from the data.

Comparability is very important when conducting meta-analysis, which combines the results of numerous studies to identify commonalities that are then hypothesized to hold over a range of experimental conditions. Meta-analysis can be very misleading if the studies being evaluated are not truly comparable. Without proper consideration of comparability, the findings of the meta-analysis may be due to an artifact of methodological differences among the studies rather than due to differences in experimentally controlled conditions. The use of expert opinion to classify the importance of differences in characteristics among data sets is invaluable (EPA 1998a, Page D3).

1.4.6 Measurement Performance Criteria

While the quality objectives state data user needs, they do not provide sufficient information about how these needs can be satisfied. One of the most important features of the QAPjP is that it links the data user's quality objectives to verifiable measurement performance criteria.

1.4.6.1 CLP and ER Targets. Tables 1-2, 1-3, 1-4, and 1-6 through 1-11 contain EPA CLP target analyte lists (TALs), ER target radionuclide lists, toxicity characteristic leaching procedure (TCLP) TALs, and miscellaneous analytes and test methods. These tables define the TALs that are either typically used or commonly available through laboratory subcontracts placed by the SMO. The required detection or quantification limits listed are those found in SMO master task subcontract SOWs. If different target analytes, analytical methods or detection limits are required by a project, the specific requirements will be called out in FSPs, work plans, or other project planning documents.

Table 1-5 contains minimum requirements for collecting field QC samples. The requirements are based on latest EPA guidance (EPA 1987a, Page 12; Harris 1990, Section 6.1, Pages 2–4) with some exceptions agreed to in a conference between DOE-ID, EPA Region X, and IDEQ. For sampling activities involving only soil, trip blanks are not recommended.

For cases in which more or less stringent field QC requirements than those recommended in Table 1-5 are determined to be necessary, the rationale and requirements will be specified in the project-specific FSP or test plan.

1.4.6.2 Detection Limits. Detection limits must not exceed one-tenth the risk-based or decision-based concentrations for the contaminants of concern. The one-tenth value is used to ensure that contaminants of interest can be accurately quantified at the decision level. The detection limits listed in this QAPjP are published CRQLs for CLP organics (EPA 1999, Pages C-3 through C-8), or CRDLs for CLP inorganics (EPA 1993a, Pages C-1 and C-2); estimated quantitation limits (EQLs) for TCLP volatile or semivolatile organics, or required quantitation limits (RQLs) for TCLP metals, or EQLs or method detection limits for pesticides, herbicides, and miscellaneous analytes (EPA 1986); and CRDLs as defined in the ER radiological SOW (INEL 1995a, Page 14). The tables in this QAPjP must be consulted when determining methods that will meet the DQOs of the project. If special analytical methods are required to meet acceptable detection levels, SMO personnel must be informed of this when requesting analytical services for the project.

Some groundwater samples will be analyzed for volatile organic compounds using EPA Method 524.2 (EPA 1992) or SW-846 Method 8260B (EPA 1986) using a 25-mL sample volume because the CLP detection limits are too high for evaluating the groundwater ingestion pathway in a risk assessment (Cirone 1990). If required detection limits for any analyses are lower or higher than those listed in the ER MTA SOWs, then those detection limits will be described in the project-specific FSP, test plan, and the laboratory task order SOW. Detection and/or quantitation limits are shown in Tables 1-2, 1-3, 1-4, and 1-6 through 1-11.

Table 1-6. Required detection limits (RDLs) under inorganic and miscellaneous classical analyses (I&MCA) master task agreements (MTAs).

SDG Type-1A (CERCLA metals) and SDG Type 1B (RCRA metals, excluding TCLP and Universal Treatment Standard [UTS])[a, b]		SDG Type-1B (UTS metals)[a, b]			SDG Type-1C (SDWA[d] and NPDES[e] metals)[a, b]		SDG Type-2 (TCLP metals)[a, b]		SDG Type-3 (SDWA and NPDES miscellaneous)[a, b]	
Analyte	RDL[c] (µg/L)	Analyte	Wastewater RDL[c] (µg/L)	Nonwastewater RDL[c] (µg/L TCLP)	Analyte	RDL[c] (µg/L)	Analyte	RDL[c] (µg/L)	Analyte	RDL[c] (mg/L)
Aluminum	200	Antimony	90	50	Aluminum	10	arsenic	250	Chloride	50
Antimony	60	Arsenic	70	250	Antimony	1.2	barium	1,000	Fluoride	0.4
Arsenic	10	Barium	60	1,000	Arsenic	10	cadmium	50	Nitrate-N	2
Barium	200	Beryllium	40	60	Barium	200	chromium	250	Nitrate-nitrite-N	2
Beryllium	5	Cadmium	30	5	Beryllium	0.8	lead	250	Nitrite-N	0.2
Cadmium	5	Chromium	100	30	Cadmium	1.0	mercury	2	Phenols	0.001
Calcium	5,000	Lead	30	30	Calcium	250	selenium	50	Sulfate	50
chromium	10	Mercury	5	1	Chromium	10	silver	250	Sulfide	0.01
Cobalt	50	Nickel	150	550	Copper	25			Surfactants	0.1
Copper	25	Selenium	40	250	Iron	60			Total dissolved solids (TDS)	100
Iron	100	Silver	20	5	Lead	3.0				
Lead	3	Thallium	70	10	Magnesium	250				
Magnesium	5,000	Vanadium	200	80	Manganese	10				
Manganese	15	Zinc	100	200	Mercury	0.2				
Mercury	0.2				Nickel	20				
Nickel	40				Potassium	250				
Potassium	5,000				Selenium	5.0				
Selenium	5				Silver	10				
Silver	10				sodium	250				
Sodium	5,000				thallium	0.4				

Table 1-6. (continued).

SDG Type-1A (CERCLA metals) and SDG Type 1B (RCRA metals, excluding TCLP and Universal Treatment Standard [UTS])[a, b]		SDG Type-1B (UTS metals)[a, b]			SDG Type-1C (SDWA[d] and NPDES[e] metals)[a, b]		SDG Type-2 (TCLP metals)[a, b]		SDG Type-3 (SDWA and NPDES miscellaneous)[a, b]	
Analyte	RDL[c] (µg/L)	Analyte	Wastewater RDL[c] (µg/L)	Nonwastewater RDL[c] (µg/L TCLP)	Analyte	RDL[c] (µg/L)	Analyte	RDL[c] (µg/L)	Analyte	RDL[c] (mg/L)
Thallium	10				Zinc	20				
Vanadium	50									
Zinc	20									

a. A Sample Delivery Group (SDG) is defined as a unit that is used to simultaneously identify both the samples and associated analytical data from a group of 20 or fewer field samples that were collected from a common site within a short enough timeframe (not to exceed 14 calendar days) so that all requested analyses could be performed by the subcontracted laboratory before any of the analytical holding times had expired or required data delivery schedules were impacted.

b. An SDG type is defined as a general character or form common to a group of samples or corresponding sample data that: (1) sets them off as a distinguishable class, (2) pertains to a group of samples that conform to the definition of an SDG, and (3) have been distinctively categorized (i.e., SDG Type-1A, SDG Type-1B, SDG Type-1C, SDG Type-2, and SDG Type-3) in the I&MCA MTA SOW (ER-SOW-156 [INEL 1995c]).

c. RDLs are specified on a weight to volume basis (e.g., µg/L). For nonaqueous samples, specified RDLs apply to the neat solution (digestate, distillate, extractant, etc.) from the applicable sample preparation methods.

d. SDWA = Safe Drinking Water Act.

e. NPDES = National Pollutant Discharge Elimination System.

Table 1-7. ER radionuclide analysis list.[a]

Radionuclides[b]		Contract-Required Detection Limits[c] Soil (pCi/g)	Water (pCi/L)
Alpha Spectrometry			
Americium	(Am-241)	0.05	0.2 *
Curium	(Cm-242, 244)	0.05	0.2
Neptunium	(Np-237)	0.05 *	0.2 *
Plutonium	(Pu-238, 239/240, 242)	0.05	0.2 *
Thorium	(Th-228, 230, 232)	0.05	0.5 *
Uranium	(U-234, 235, 238)	0.05 *	0.5 *
Gamma Spectrometry[d]			
Antimony	(Sb-125)	~0.1	~30
Cerium	(Ce-144)	~0.1	~30
Cesium	(Cs-134, 137)	0.1[d] *	30[d] *
Cobalt	(Co-60)	~0.1	~30
Europium	(Eu-152, 154, 155)	~0.1	~30
Manganese	(Mn-54)	~0.1	~30
Ruthenium	(Ru-106)	~0.1	~30
Silver	(Ag-108m, 110m)	~0.1 *	~30 *
Zinc	(Zn-65)	~0.1	~30
Other[e]	(Results > 2σ and > minimum detectable activity [MDA])[e]	~0.1	~30
Specific Analyses			
Carbon	(C-14)	3	3
Iodine	(I-129)	1 *	1 *
Iron	(Fe-55)	5	5
Nickel	(Ni-59)	5	5
Nickel	(Ni-63)	5	5
Plutonium	(Pu-241)	1	10 *
Radium	(Ra-226)[f]	0.5 *	1 *
Radium	(Ra-228)	0.5	1

Table 1-7. (continued).

Radionuclides[b]	Contract-Required Detection Limits[c] Soil (pCi/g)	Water (pCi/L)
Strontium (Sr-89)	0.5	1
Strontium (Sr-90)	0.5	1
Strontium (Sr-89/90) total	0.5	1
Technetium (Tc-99)	1	10 *
Tritium (H-3)	20	400
Indicator Analyses		
Gross Alpha (gross α)	10	4
Gross Beta (gross β)	10	4

a. This analysis (target) list does not imply that the analysis must include all radionuclides on this table.

b. The analysis might include radionuclides not on this table (contact the SMO).

c. All listed CRDLs are sufficiently low to meet most sample analysis needs. They are 10 times lower than all 10^{-4} and most 10^{-6} residential 100-year risk-based limits. The CRDLs are based on ideal sample and analysis conditions. Actual detection limits achieved by the laboratory may vary, depending on the radionuclide concentrations, sample matrix, sample size, counting times, and detection system.

d. The CRDL applied to all gamma-emitting radionuclides is based on Cs-137. The detection limits of other gamma radionuclides will differ from that of Cs-137 (i.e., 0.1 pCi/g and 30 pCi/L); however, they are commensurate with that for Cs-137, taking into account differences in gamma-ray energies and branching ratios (gamma emission probabilities).

e. Naturally occurring radionuclides are not reported unless the measured concentrations are notably greater than what would normally be expected for the particular sample matrix.

f. A separate, specific analysis is required for Ra-226. Ra-226 is not included in the standard INEEL target analyte list for gamma-emitting radionuclides. Contact the SMO if clarification or additional information is needed.

* CRDLs shown with an asterisk (*) are higher than one tenth of the 10^{-6} risk-based limits (i.e., they are not 10 times lower than an activity that corresponds to the 10^{-6} risk-based limit), and thus may not meet project/program requirements for making 10^{-6} risk-based decisions. See footnote c above. The option to request lower CRDLs is possible for some radionuclides (contact the SMO). See further discussion in Section 1.4.6.2 of this QAPjP.

Table 1-8. EPA Drinking Water Method 524.2 target analyte list.

Compound [a]	CAS Number	Method Detection Limits[b] (μg/L)	
		Wide Bore Column	Narrow Bore Column
Acetone	67-64-1	0.28	ND
Acrylonitrile	107-13-1	0.22	ND
Allyl chloride	107-05-1	0.13	ND
Benzene	71-43-2	0.04	0.03
Bromobenzene	108-86-1	0.03	0.11
Bromochloromethane	74-97-5	0.04	0.07
Bromodichloromethane[d]	75-27-4	0.08	0.03
Bromoform	75-25-2	0.12	0.20
Bromomethane	74-83-9	0.11	0.06
2-Butanone	78-93-3	0.48	ND
Carbon disulfide	75-15-0	0.093	ND
Carbon tetrachloride[d]	56-23-5	0.21	0.08
Chloroacetonitrile	107-14-2	0.12	ND
Chlorobenzene	108-90-7	0.04	0.03
1-Chlorobutane	109-69-3	0.18	ND
Chloroethane	75-00-3	0.10	0.02
Chloromethane	74-87-3	0.13	0.05
Chloroform[d]	67-66-3	0.03	0.02
2-chlorotoluene	95-49-8	0.04	0.05
4-chlorotoluene	106-43-4	0.06	0.05
cis-1,2-dichloroethene	156-59-4	0.12	0.06
cis-1,3-dichloropropene[d]	10061-01-5	ND	ND
Dibromochloromethane	124-48-1	0.05	0.07
Dibromomethane	74-95-3	0.24	0.03
1,2-Dibromoethane[c,e]	106-93-4	0.06	0.02
1,2-dibromo-3-chloropropane[c,e]	96-12-8	0.26	0.05
1,2-dichlorobenzene	95-50-1	0.03	0.05
1,3-dichlorobenzene	541-73-1	0.12	0.05
1,4-Dichlorobenzene[d]	106-46-7	0.03	0.04
Dichlorodifluoromethane	75-71-8	0.10	0.11
1,1-dichloroethane	75-34-3	0.04	0.03
1,2-dichloroethane[d]	107-06-2	0.06	0.02

Table 1-8. (continued).

Compound [a]	CAS Number	Method Detection Limits[b] (μg/L) Wide Bore Column	Method Detection Limits[b] (μg/L) Narrow Bore Column
1,1-dichloroethene[e]	75-35-4	0.12	0.05
1,2-dichloropropane[e]	78-87-5	0.04	0.02
1,3-dichloropropane	142-28-9	0.04	0.04
2,2-dichloropropane	590-20-7	0.35	0.05
1,1-dichloropropene	563-58-6	0.10	0.02
1,1-Dichloropropanone	513-88-2	1.0	ND
Diethyl ether	60-29-7	0.28	ND
Ethylbenzene	100-41-4	0.06	0.03
Ethyl methacrylate	97-63-2	0.028	ND
Hexachlorobutadiene[d]	87-68-3	0.11	0.04
Hexachloroethane	67-72-1	0.057	ND
2-Hexanone	591-78-6	0.39	ND
Isopropylbenzene	98-82-8	0.15	0.10
4-Isopropyltoluene	99-87-6	0.12	0.26
Methacrylonitrile	126-98-7	0.12	ND
Methylacrylate	96-33-3	0.45	ND
Methylene chloride	75-04-2	0.03	0.09
Methyl iodide	74-88-4	0.019	ND
Methylmethacrylate	80-62-6	0.43	ND
4-Methyl-2-pentanone	108-10-1	0.17	ND
Methyl-t-butyl ether	1634-04-4	0.09	ND
n-butylbenzene	104-51-8	0.11	0.03
n-propylbenzene	103-65-1	0.04	0.06
Naphthalene	91-20-3	0.04	0.04
Nitrobenzene[e]	98-95-3	1.2	ND
2-Nitropropane	79-46-9	0.16	ND
Pentachloroethane	76-01-7	0.14	ND
Propionitrile	107-12-0	0.14	ND
sec-butylbenzene	135-98-8	0.13	0.12
Styrene	100-42-5	0.04	0.06
tert-butylbenzene	98-06-6	0.14	0.33
1,1,1,2-tetrachloroethane	630-20-6	0.05	0.04
1,1,2,2-tetrachloroethane[d]	79-34-5	0.04	0.20

Table 1-8. (continued).

Compound [a]	CAS Number	Method Detection Limits[b] (µg/L) Wide Bore Column	Method Detection Limits[b] (µg/L) Narrow Bore Column
trans-1,2-dichloroethene	156-60-5	0.06	0.03
trans-1,3,-dichloropropene[e]	10061-02-6	ND	ND
trans-1,4-Dichloro-2-butene[e]	110-57-6	0.36	ND
Tetrachloroethene	127-18-4	0.14	0.05
Tetrahydrofuran	109-99-9	1.6	ND
1,2,3-trichlorobenzene	87-61-6	0.03	0.04
1,2,4-trichlorobenzene	120-82-1	0.04	0.20
1,1,1-trichloroethane	71-55-6	0.08	0.04
1,1,2-trichloroethane[d]	79-00-5	0.10	0.03
Trichloroethene	79-01-6	0.19	0.02
Trichlorofluoromethane	75-69-4	0.08	0.07
1,2,3-trichloropropane[e]	96-18-4	0.32	0.03
1,2,4-trimethylbenzene	95-63-6	0.13	0.04
1,3,5-trimethylbenzene	108-67-8	0.05	0.02
Toluene	108-88-3	0.11	0.08
Vinyl chloride[e]	75-01-4	0.17	0.04
o-Xylene	95-47-6	0.11	0.06
m-Xylene	108-38-3	0.05	0.03
p-Xylene	106-42-3	0.13	0.06

a. This is the list of compounds for which EPA Method 524.2 is approved. The specific analytes that are to be determined using that method will be specified by the SMO in master task subcontract SOWs or by the project when requesting the SMO to prepare Task Order Statements of Work.

b. When no matrix effects are present, these method detection limits (MDLs) are also achievable using EPA Method 8260B and a 25-m sample volume.

c. This compound is regulated under the National Primary Drinking Water Regulations, and one tenth of the MCL is less than the listed MDLs. One of the two listed MDLs is less than the relevant MCL for this compound. When MCLs are a project ARAR, specifying the requirements for the analytical column to use will be necessary when requesting the SMO to obtain the analytical services.

d. The MDLs listed for this compound are greater than one tenth of the 10^{-6} risk-based screening level for tap water as specified in the EPA Region IX PRGs. At least one of the two MDLs listed is less than the 10^{-6} risk-based screening level for tap water.

e. The MDLs listed for this compound are greater (in some cases much greater) the one tenth of the 10^{-6} risk-based screening level for tap water. If this compound is a contaminant of concern, negotiations concerning an acceptable risk to which it should be evaluated and the potential need to use alternative and costly analytical methods must be discussed during project planning.

Table 1-9. TCLP volatile organic target compound list.[a]

Compound	CAS Number	EQLs[a] (µg/L)
Benzene[b]	71-43-2	25
Carbon tetrachloride	56-23-5	25
Chlorobenzene[b]	108-90-7	25
Chloroform	67-66-3	25
1,2-dichloroethane	107-06-2	25
1,1-dichloroethylene[b]	75-35-9	25
Methyl ethyl ketone (2-butanone)	78-93-3	100
Tetrachloroethylene	127-18-4	25
Trichloroethylene[b]	79-01-6	25
Vinyl chloride	75-01-4	20

a. SW-846 Method 8260B (EPA 1986). The EQLs listed are for aqueous samples. EQLs are highly matrix-dependent, and may not always be achievable.

b. Precision and accuracy criteria regarding matrix spike/matrix spike duplicate for these compounds are the same as those specified in Table 1-2.

Table 1-10. TCLP semivolatile organic target compound list.[a,b]

Compound	CAS Number	EQLs (µg/L)
2-methylphenol(o-cresol)	95-48-7	50
3-methylphenol(m-cresol)	108-39-4	50
4-methylphenol(p-cresol)	106-44-5	50
Total cresol	—	50
1,4-dichlorobenzene[c]	106-46-7	50
2,4-dinitrotoluene[c]	121-14-2	13
Hexachlorobenzene	118-74-1	13
Hexachlorobutadiene	87-68-3	50
Hexachloroethane	67-72-1	50
Nitrobenzene	75-01-4	50
Pentachlorophenol[c]	87-86-5	250
Pyridine	110-86-1	50
2,4,5-trichlorophenol	95-95-4	250
2,4,6-trichlorophenol	88-06-2	50

a. SW-846 Method 8270C (EPA 1986). The EQLs listed are for aqueous samples. EQLs are highly matrix dependent and may not always be achievable.

b. For waste characterization activities to characterize waste to meet the Envirocare waste acceptance criteria, the methods recognized by the State of Utah Bureau of Laboratory Improvement Environmental Laboratory Certification program will be used. The MDLs may vary when these older methods are used.

c. Precision and accuracy criteria regarding matrix spike/matrix spike duplicate for these compounds are the same as those specified in Table 1-3.

Table 1-11. TCLP pesticides/herbicides target compound list.

Pesticides/Herbicides	CAS Number	Method 8081A[c] MDL (µg/L)	Methods 8151A[c] MDL (µg/L)	TCLP EQL's (µg/L)
Chlordane[a]	57-74-9	NA[d]	NA	3.0
2,4-D[b]	94-75-7	NA	0.2	1,000
Endrin[a]	72-20-8	0.82	NA	2.0
Heptachlor[a]	76-44-8	0.56	NA	0.8
Lindane[a]	58-89-9	0.32	NA	40
Methoxychlor[a]	72-43-5	NA	NA	1,000
Toxaphene[a]	8001-35-2	NA	NA	50
2,4,5-TP(silvex)[b]	93-72-1	NA	0.075	100

a. SW-846 Method 8081A (EPA 1986).

b. SW-846 Method 8151A (EPA 1986).

c. For waste characterization activities to characterize waste to meet the Envirocare waste acceptance criteria, the methods recognized by the State of Utah Bureau of Laboratory Improvement Environmental Laboratory Certification program will be used. The MDLs may vary when these older methods are used.

d. NA = Data not available.

1.5 Special Training Requirements/Certifications

The purpose of this section is to ensure that any specialized training requirements necessary to complete the projects are known and furnished and the procedures are described in sufficient detail to ensure that specific training skills can be verified, documented, and updated as necessary.

1.5.1 Training

General training requirements for work at CERCLA/RCRA cleanup sites:

- Site-specific HASP training, 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operator (HAZWOPER) training for project employees (24 hours of field supervised training), 24-hour OSHA HAZWOPER training for nonproject employees (8 hours of field supervised training)
- Radiation Worker I or II (for radiologically contaminated sites only)
- Hazard Communications training
- Hearing Conservation Program training, as required
- Site-Specific Hazards Awareness training
- Daily Job Briefings (Plan-of-the-Day meetings)
- Nonroutine Field Sampling Techniques

- Hazardous Material Awareness training (shipping requirements).

Not all of the above training is required for each project. Additional training may be required by some projects. The project-specific HASP defines the specific training required for the project.

1.5.2 Certification

Certification requirements:

- Asbestos abatement certification, as required
- Lead abatement certification, as required
- Medical surveillance determination and certification as fit for duty, determined by Industrial Hygiene exposure assessment
- Safe work permit and radiological work permit requirements.

Site-specific training requirements are listed in the individual project-specific HASPs. All certifications or documentation representing completion of specialized training are maintained in training files.

1.6 Documentation and Records

All documents used to perform work by or for ER are controlled documents. Controlled documents are reviewed by specific technical and compliance professionals and approved as specified by the FFA/CO. Changes to controlled documents are completed by initiating a Document Action Request (DAR) and obtaining reviews and approval by the same organizations that approved the original document.

Before a laboratory is awarded a subcontract to analyze samples for the SMO, a thorough, systematic, qualitative audit of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management and reporting, and waste management practices is completed. The record of that audit, corrective actions, responses, and closure are retained by Procurement.

1.6.1 Field Operation Records

All project records are retained as specified in the FFA/CO, Section XX, "Retention of Records and Administrative Record." Those records are scanned into an OIS and retained as permanent records or as instructed by the EPA and IDEQ. Records are provided to the records coordinators by the PMs for retention. The records are presently stored in the Technical Support Building on Foote Drive in Idaho Falls, Idaho. Examples of specific record types are described below.

1.6.1.1 Sample Logbook. Field samplers are required to maintain a sample logbook during a sampling project. The sample logbooks are issued by the Field Data Coordinator (FDC) and returned to the FDC when the project is completed or the logbook is full. The FDC gives the logbooks to the records coordinator. The following information is recorded in the sample logbook:

- Sampling location
- Depth or depth interval

- Field personnel
- Document numbers of standard and/or detailed operating procedures
- Types and numbers of samples collected
- Collection method, time and date of sample collection
- Type and preparation of sample bottles, preservation of samples
- Field measurement data
- Weather conditions
- Ambient temperature
- Barometric pressure
- Any observations about conditions or incidents affecting sampling activities and/or sample quality
- Preparation and submission of field quality control samples including frequency, preservation, standards traceability, and calibration of instruments used
- Work/quality assurance plan number
- Any deviations from the characterization plan used for the project (Changes to the characterization plans are made using a DAR.)
- If deviations from the characterization plan are not made, routine information such as sampling locations or standard operating procedures used does not have to be explicitly stated in the narrative section of the logbook.
- Sign the "Recorded by" line immediately after concluding each sampling activity.

1.6.1.2 Field Team Leader's Daily Logbook. The FTL maintains a daily logbook during a sampling/data collection activity to provide a daily record of events, observations, and measurements. The FTL daily logbook is controlled by the FDC in the same fashion as described for sample logbooks. This logbook may be combined with the sample logbook.

1.6.1.3 Calibration Logbook. Where required, a calibration logbook is maintained. The logbook includes all pertinent information about the piece of equipment, date of last calibration, serial number of equipment, when and where used, and calibration standard used. The logbook is controlled by the FDC in the same fashion as described for sample logbooks. Radiological control technicians (RCTs) maintain a use log for survey instruments. That log is used to record time, method, results, and name of individual performing the survey.

1.6.1.4 Sample Shipping Logbook. The FTL or designee is required to maintain this logbook to record information such as the date each sample is sent to a laboratory, name of the laboratory, and chain-of-custody number.

1.6.1.5 Chain-of-Custody. The FTL or designee is required to complete a chain-of-custody form for each sample or set of samples collected. A copy of the chain-of-custody is retained with the logbook. The original chain-of-custody form accompanies the samples to the laboratory and is returned with the sample results. The original chain-of-custody is retained as an ER record.

1.6.1.6 Corrective Action Reports. Corrective action reports, if used, are provided to the ER records coordinator for retention as an ER record.

1.6.1.7 Field Procedures. Field procedures are controlled documents maintained by the document control coordinator. The actual revisions of the procedures used are noted in the various field logbooks and that revision is retrievable via the document control system.

1.6.1.8 Quality Assurance Project Plan. This QAPjP will be retained as a record. All previous versions of the QAPjP are available from the records coordinator and are stored on the OIS.

1.6.1.9 Field Sampling Plans. The FSPs are controlled documents and are available from the document control coordinator. Previous versions of the FSP, if revised, are retained by the document control coordinator and on the OIS.

1.6.1.10 Remedial Design/Remedial Action Work Plan. The RD/RA work plans are controlled documents controlled by the document control coordinator. If changes are made to the work plan, the previous version is retained and scanned into the OIS.

1.6.2 Data Handling Records

The requirements, responsibilities, and procedures for managing records within ER are described in Sections 1.6.3–1.6.5.

1.6.3 Laboratory Records

Laboratory records include both those maintained exclusively on-Site by the laboratories (internal laboratory records) and those required to be submitted to the INEEL under the terms of the applicable MTAs (external laboratory records). The types of records included in each category are as follows:

1.6.3.1 Internal Laboratory Records. Before the awarding of the MTA, cognizant INEEL personnel perform an onsite audit at the laboratory's facilities. Most of the documentation reviewed (e.g., standard operating procedures and associated logbooks) never leaves the premises. Upon the awarding of the MTA, laboratory personnel are required to initiate and maintain documentation for various laboratory activities associated with INEEL work. This documentation requirement may be met by using computerized storage and/or either hardbound or unbound logbooks. The requirement is that the system chosen shall allow for storage, easy audit review, and ready retrieval (chronologically sequenced in paginated hard copy form) of all required information throughout the duration of the MTA. Activities required to be documented include things such as laboratory equipment (e.g., balances and piston or plunger operated volumetric pipettes) calibration checks, fume hood airflow checks, instrument service, standards tracking, reagent water monitoring, water purification system maintenance, sample receipt and internal tracking, pH verification, sample preparation, analysis runs, and data shipments. Although this documentation is maintained and stored onsite at the laboratory facility, laboratory personnel are contractually obligated to submit pertinent copies to the INEEL upon request.

1.6.3.2 External Laboratory Records. For any given INEEL project specific sampling event in which analytical services are procured under an MTA, the resulting external laboratory records consist of

one or more data packages, each containing data from 20 or less field samples processed under only one analytical discipline (i.e., I&MCA, organic, or radiological). Each data package is formatted according to one of three distinct reporting tiers (Tier-1, Tier-2, or Tier-3). The extensiveness of the reporting tiers decreases from Tier-1 to Tier-3. Tier-1 data are comparable to an EPA CLP data package in that specified report forms, for recording all field sample and associated QC sample results, and a complete compilation of pertinent raw data are mandated. Raw data is not included with either a Tier-2 or Tier-3 data package and the reporting requirements are much less formal than those for Tier-1 data. However, all raw data is required to be maintained as internal laboratory records so that any given Tier-2 or Tier-3 data package can be upgraded to Tier-1 status.

1.6.4 Document Control

External laboratory records are stored and managed in accordance with contractor procedures. The INEEL contractor maintains procedures that specify requirements for appropriately completing field logbooks, making revisions to logbook data, and other logbook requirements. These requirements include the use of indelible and waterproof ink to make logbook entries, that corrections are made using a single line and are dated and initialed by the person making the change, and that completed logbooks are returned to the SMO field data coordinator for archiving. Records management requirements for completed logbooks and all sample analysis data are also found in the *Records Management Plan for the Idaho National Engineering Laboratory Environmental Restoration Program* (INEL 1995d).

1.6.5 Data Reporting Package Archival and Retrieval

The requirements for data reporting package archiving and retrieval are specified in *Records Management Plan for the Idaho National Engineering Laboratory Environmental Restoration Program* (INEL 1995d). The records management plan requires permanent storage of essentially all environmental records. For data packages received from the sample analysis laboratories and the data validation reports produced using these data, the SMO archives and retrieves the data. The environmental records are permanently stored at the Technical Support Building in locked storage.

2. DATA ACQUISITION

2.1 Sampling Process Design

This section provides a general discussion of sampling process design. The project-specific FSPs, test plans, or work plans describe the relevant components of the sampling design, defines the key parameters to be estimated, indicates the number and type of samples expected, and describes where, when, and how samples are taken. This section of the QAPjP addresses generic processes associated with sampling design, scheduling activities, rationale for design, design assumptions, procedures for locating and selecting samples, classification of measurements, and validation of nonstandard methods.

2.1.1 Field Investigations

The primary objective of field investigations is to obtain data that will help determine if no further action or an interim action is appropriate, based on the risk(s). A Track 2 investigation may also lead to an RI if additional information is required for remedy selection. The primary objective of an RI is to provide adequate information to determine the nature and extent of the threat posed by a site, which leads to a determination of no further action or remedial action (INEL 1991a, Pages 8–15). Field investigations are also used to determine what type of remedial action or removal action is necessary to reduce or eliminate risk. During RD/RA, data collection activities ensure remedial action objectives have been met.

The objective of an FSP, sampling and analysis plan, or test plan, and this QAPjP, is to ensure that data meet the DQOs by providing a mechanism for planning and approving field activities. Specifically, the field data collection and subsequent data interpretation must define the nature and extent of contamination such that the associated risk(s) can be adequately defined.

The project-specific sampling design(s) will be addressed in the project-specific FSP or test plan and, unless referenced, will include the description of the conceptual model. Historically, Track 2 investigations or RIs had conceptual models where evaluation elements were identified. These elements include source (location and concentration of contaminants over time), pathway (media, rate of migration, and time and loss functions), and receptors (type, sensitivity, time, concentration, and number) (EPA 1987a, Pages 3-6 through 3-9).

Field investigation sampling design features that will be addressed in the project-specific FSP or test plan include a list of all measurements, differentiating critical from non-critical samples, total number of samples, type of samples, and measurements planned for each sample (EPA 1989a, Page 36). Critical samples are those samples required to achieve project objectives or limits on decision errors. Non-critical samples are those samples needed for information (EPA 1998a).

2.1.2 Sample Site Selection

The objective of the site selection and sampling procedures is to obtain samples that represent the environment being investigated or meet the scientific objectives of the project.

The DQOs are the scientific basis for the site selection. The sample population may be designed to be representative of the soil, water, or other media being investigated, or may be nonrepresentative to meet the scientific objectives of the project. The statistical method(s) and/or scientific objective(s) for determining sampling sites and frequency are included in EPA guidance (EPA 1989b, Pages 75, 140–169; EPA 1989c, Pages 5-1 through 5-19). If the samples are collected in the recommended locations, the sample data will meet the project objectives. Variations from the proposed sample site(s) and the resulting

impacts on the DQOs of the project will be documented in the project report (for example, RI report, summary report).

2.1.3 Sample Site Description

The samples will be collected using EPA- and industry-accepted practices from the references listed above. The project-specific DQOs and the critical measurements will be described in the project-specific FSP or test plan. A map of the proposed sample locations will be included in the project-specific FSP or test plan, and a map of the actual sample locations will be included in the project report (for example, RI report, summary report).

2.2 Sampling Methods Requirements

This section describes the procedure for collecting samples and identifies the sampling methods and equipment, including any implementation requirements, support facilities, sample preservation requirements, and materials needed.

The number and type of samples and analyses will be described in the project-specific FSP or test plan. In addition, the FSP or test plan will include a list of sample-specific analytes and state the sampling method (e.g., grab). If an ASTM- or EPA-approved method is used, it will be cited in the FSP. References for the most commonly used methods are listed below.

- *Soil Sampling and Analysis for Volatile Organic Compounds* (EPA 1991b, Pages 1–22)
- *Characterizing Soils for Hazardous Waste Site Assessments* (EPA 1991c, Pages 1–16)
- *A Compendium of Superfund Field Operations Methods* (EPA 1987b, Pages 7-1 through 7-9, 8.1-1 through 8.4-51, 13-1 through 13-10, 15-1 through 15-58)
- *Statement of Work for Organic Analysis-Multi-Media, Multi-Concentration* (EPA 1999)
- *Statement of Work for Inorganic Analysis-Multi-Media, Multi-Concentration* (EPA 1993a)
- *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods* (EPA 1986)
- *Methods for the Chemical Analysis of Water and Wastes* (EPA 1983).

If the sampling method is not an EPA-approved method, it will be described in detail in the project-specific FSP or test plan. Tables 2-1 and 2-2 of this QAPjP summarize the sample volumes, preservation, container types, and holding times (both before and after extraction) for many of the typically required analyses. Additions to, or deviations from, the guidelines in the tables (e.g., a test for which no requirements are listed or insufficient sample material will be available) will be detailed in the project-specific TOS/SOW and incorporated into the FSP or test plan. The ASTM or EPA sampling methods will be used whenever possible during the sampling process (EPA 1987b, Pages 6-1 through 6-16). If those methods are not applicable, more specific procedures have been developed, or management control procedures (MCPs) or standard operating procedures (SOPs)/technical procedures (TPRs) are used, those procedures (including the MCP or SAP/TPR revision number) will be referenced in or attached to the project-specific FSP or test plan. If samples cannot be collected at the designated location, the field team leader selects an alternate location and documents that new location in the field logbook. If samples cannot be collected at an alternate location, the field team leader contacts the INEEL contractor project manager to obtain a new sampling strategy. If a new sampling strategy is necessary, the

Table 2-1. Summary of sample collection, holding time, and preservation requirements.

Analysis	Sample Medium[a]	Volume/Mass	Container Type[l]	Holding Time	Preservative
Radiochemistry (See Table 2-2)	Water	See Table 2-2	See Table 2-2	See Table 2-2	See Table 2-2
Alpha Spectroscopy Americium (Am-241) Curium (Cm-242, 244) Neptunium (Np-237) Plutonium (Pu-238, 239/240, 242) Thorium (Th-228, 230, 232) Uranium (U-234, 235, 238)	Soil	≥10 g (per isotope or isotope combination)	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Gamma Spectroscopy Antimony (Sb-125) Cerium (Ce-144) Cesium (Cs-134, 137) Cobalt (Co-60) Europium (Eu-152, 154, 155) Manganese (Mn-54) Ruthenium (Ru-106) Silver (Ag-108m, 110m) Zinc (Zn-65) Other[e] (Results >2σ and > MDA)[e]	Soil	150—600 g (per sample)	16-oz wide-mouth jar	Analyze within 6 months[a,b]	None

Table 2-1. (continued).

Analysis	Sample Medium[a]	Volume/Mass	Container Type[l]	Holding Time	Preservative
Other Radionuclides Carbon (C-14) Iron (Fe-55) Nickel (Ni-59) Nickel (Ni-63) Plutonium (Pu-241) Strontium (Sr-89) Strontium (Sr-90) Strontium (Sr-89/90) Total Technetium (Tc-99)	Soil	≥10 g (per individual isotope)	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Tritium (H-3)	Soil	5—200 g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None/
Iodine (I-129)	Soil	10—15 g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None/
Radium (Ra-226)	Soil	150—200 g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Radium (Ra-228)	Soil	150—200 g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
CLP metals	Soil	250 mL	Wide-mouth jar (glass or polyethylene)	Analyze within 6 months, except analyze Hg within 28 days.[c]	4°C[c]
CLP metals by Method SW-846	Water	2,000 mL	HDPE or low density polyethylene (LDPE) bottle	Analyze within 6 months, except analyze Hg within 28 days.[c]	HNO_3 to pH<2[c]
CLP volatiles	Soil	125 mL	Wide-mouth glass jar	Analyze within 14 days.[d]	4°C[d]
CLP volatiles	Water	2 × 40 mL[e]	40-mL glass vials	Analyze within 14 days.[d]	4°C, to pH <2 [d]
SW-846 Method 8260 volatiles	Water	2 × 40 mL[e]	40-mL glass vial, Teflon lined cap[k]	Analyze within 14 days.[j]	4°C (add H_2SO_4 to pH<2 as necessary)[j]
Volatile organics	Gas	Variable	Tedlar bag or summa canister	28 days from sample receipt to analysis	Ambient temperature
CLP semivolatiles[f]	Soil	250 mL	Wide-mouth glass jar	Extract within 14 days, analyze extracts within 40 days of extraction.[d]	4°C[d]
CLP semivolatiles[f]	Water	1,000 mL[e]	Amber glass jugs	Extract within 7 days, analyze extracts within 40 days of extraction.[d]	4°C[d]

Table 2-1. (continued).

Analysis	Sample Medium[a]	Volume/Mass	Container Type[l]	Holding Time	Preservative
Acrolein and Acrylonitrile	Water	2 x 40 mL[e]	40-mL glass vials with Teflon lined cap	14 days	4°C, adjust pH to 4-5
Anions	Soil	250 mL	Wide-mouth jar (glass, polyethylene, or HDPE)	Analyze within 48 hours for NO_3 and PO_4. All others 28 days.[g]	4°C[g]
Anions	Water	500 mL	HDPE, polyethylene, or glass bottle	Analyze within 48 hours for NO_3 and PO_4. All others 28 days.[g]	4°C[g]
TCLP volatiles	Soil	250 mL	Wide-mouth glass jar, Teflon lined cap	Extract using zero headspace extraction (ZHE) within 14 days, analyze within 14 days of the ZHE.[h]	4°C[h]
TCLP metals/semivolatiles/ pesticides/herbicides	Soil	2,000 mL[I]	Wide-mouth glass jar, Teflon lined cap	For metals except Hg: (a) complete TCLP extraction within 6 months; and (b) complete determinative analysis (DA) within 6 months of TCLP extraction. For Hg: (a) complete TCLP extraction within 28 days; and (b) complete DA within 28 days of TCLP extraction. For semivolatiles, pesticides, and herbicides: (a) complete TCLP extraction within 14 days; (b) complete preparative extraction within 7 days; and complete DA within 40 days of the preparation extraction.[h]	4°C[h]
EPA Method 524.2 (purgeable organic compounds)	Water	2 × 40 mL[a]	40-mL glass vial, Teflon lined cap[k]	Analyze within 14 days.	4°C, (add 25 mL ascorbic acid or HCl to pH<2, as necessary)
Chromium (VI)	Water	500 mL	HDPE polyethelyene, or glass bottle	24 hours[h]	4°C[h]
Chromium (VI)	Soil	125 mL	Wide-mouth jar (glass polyethylene, or HDPE)	Extract within 30 days, analyze extract within 168 hours of extraction[m]	4°C[h]
Pesticides/PCBs	Water	1,000 mL[e]	Amber-glass jugs	Extract within 7 days, analyze extracts within 40 days of extraction[j]	4°C[j]
Pesticides/PCBs	Soil	250 mL	Wide-mouth glass jar	Extract within 14 days, analyze extract within 40 days of extraction[j]	4°C[j]

Table 2-1. (continued).

Analysis	Sample Medium[a]	Volume/Mass	Container Type[l]	Holding Time	Preservative
Total Petroleum Hydrocarbon (TPH) (Method 418.1)	Water	1,000 mL[e]	Amber glass	28 days[g]	Add 5 mL of 50% HCl per L and cool to 4°C[g]
TPH (Method 8015) (gasoline range)	Water	2 × 40 mL[e]	Amber glass, Teflon-lined cap	14 days to analyze	4°C (add HCl to pH<2 as necessary)
TPH (Method 8015) (diesel range)	Water	1,000 mL	Amber glass	Extract within 14 days, analyze within 40 days of extraction	4°C (add HCl to pH<2 as necessary)
TPH (Method 8015) (gasoline ranges)	Soil	125 mL	Amber glass jar, Teflon-lined cap	14 days to analyze	4°C
TPH (Method 8015) (diesel ranges)	Soil	250 mL	Amber glass	Extract within 14 days, analyze within 40 days of extraction	4°C

a. The holding time requirement of 6 months is described in 40 Code of Federal Regulations (CFR) 136 (EPA guidelines for analysis of pollutants) and is applied in the QAPjP as a general guideline. For analysis of volatile radionuclides not listed above and/or radionuclides with short half-lives, the holding time will be adjusted accordingly and communicated to the laboratory in a project-specific TOS (contact the SMO for more information on appropriate holding times).

b. Sludge and sediment samples should be collected and preserved equivalently to soil samples. Samples known or suspected to contain solvents must use high-density polyethylene (HDPE) containers.

c. EPA (1993a).

d. EPA (1999).

e. Once each 20 samples or 14 days, whichever comes first, 3 times the normal sample volume is required (e.g., 3,000 mL instead of 1,000 mL, 6 x 40 mL instead of 2 x 40 mL, etc.)

f. Includes other extractable organics (extra volume may be required; contact SMO).

g. EPA (1983).

h. EPA (1991d).

i. This sample volume can be reduced if sample is dry (i.e., low moisture or free liquid content) or fewer groups of parameters (e.g., metals only, or metals and semivolatiles only) are required. The SMO can provide specific guidance on sample volumes required.

j. EPA (1986).

k. Personal communication between Daryl Koch (IDEQ) and Donna Nicklaus (DOE-ID), April 4, 1994.

l. It is highly recommended that a certificate of cleanliness be obtained for all lots of sample containers used.

m. SW-846, Method 3060A (Alkaline Digestion for Hexavalent Chromium).

Table 2-2. Summary of sample collection, holding time, and preservation requirements for radiological water analyses.

Analysis	Sample Medium	Approximate Volume[a]	Container Type	Holding Time[c]	Preservative
Alpha Spectrometry					
Americium (Am-241)	Water	1 L	HDPE[b]	≤ 6 months	HNO_3 to pH <2
Curium Isotopes (Cm-242, 244)	Water	1—2 L	HDPE	≤ 6 months	HNO_3 to pH <2
Neptunium (Np-237)	Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Plutonium Isotopes (Pu-238, 239/240, 242)	Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Thorium Isotopes (Th-228, 230, 232)	Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Uranium Isotopes (U-234, 235, 238)	Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Gamma Spectrometry					
Antimony (Sb-125)	Water	0.5—2 L	HDPE	≤ 6 months	HNO_3 to pH <2
Cerium (Ce-144)					
Cesium (Cs-134, 137)					
Cobalt (Co-60)					
Europium (Eu-152, 154, 155)					
Manganese (Mn-54)					
Ruthenium (Ru-106)					
Silver (Ag-108m, 110m)					
Zinc (Zn-65)					
Other[e] (Results >2σ and > MDA)[e]					
Specific Analysis					
Carbon (C-14)	Water	0.3—1 L	HDPE	≤ 6 months	None
Iodine (I-129)	Water	1 L—5 L	Amber-colored glass[d]	≤ 6 months	None

Table 2-2. (continued).

Analysis	Sample Medium	Approximate Volume[a]	Container Type	Holding Time[c]	Preservative
Iron (Fe-55)	Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Nickel (Ni-59)	Water	0.5—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Nickel (Ni-63)	Water	0.5—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Plutonium (Pu-241)	Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Radium (Ra-226)	Water	1—4 L	HDPE	≤ 6 months	HNO_3 to pH <2
Radium (Ra-228)	Water	1—4 L	HDPE	≤ 6 months	HNO_3 to pH <2
Strontium (Sr-89)	Water	0.5—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Strontium (Sr-90)	Water	0.5—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Strontium (Sr-89/90) total	Water	0.5—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Technetium (Tc-99)	Water	0.5—2 L	HDPE	≤ 6 months	HNO_3 to pH <2
Tritium (H-3)	Water	0.1—0.5 L	HDPE/glass[e]	≤ 6 months	None
Indicator Analyses					
Gross Alpha (gross α)	Water	0.3—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Gross Beta (gross β)	Water	0.3—1 L	HDPE	≤ 6 months	HNO_3 to pH <2

a. Volumes vary depending on the requested analysis and the laboratory performing the analysis (contact the SMO).

b. HDPE = high density polyethylene.

c. The holding time requirement of 6 months is described in 40 CFR 136 (EPA guidelines for analysis of pollutants) and is applied in this QAPjP as a general guideline. For analysis of volatile radionuclides not listed above or radionuclides with short half-lives (e.g., ^{131}I), the holding times will be adjusted accordingly and disseminated to the laboratory via a project-specific TOS (contact the SMO).

d. Collecting samples for I-129 in HDPE containers is permissible/acceptable; however, the holding time requirement is 28 days instead of 6 months.

e. Samples expected to contain high levels of tritium are recommended to be stored in glass containers.

FSP and SAP will be revised and submitted for approval. Sampling equipment will be decontaminated in accordance with established procedures. The specific decontamination procedure (including revision number) applicable to the media being sampled and the levels of detection required will be cited in the project-specific FSP. The waste management section of the FSP describes the process for disposing of field decontamination waste.

2.3 Sample Handling and Custody Requirements

This section discusses procedures required to ensure samples are collected, transferred, stored, and analyzed by authorized personnel. Also discussed are procedures that ensure the integrity of samples during all phases of sample handling and analysis. An accurate written record must document sample handling and treatment from the time of its collection through laboratory procedures to disposal.

Sample custody procedures are followed to minimize accidents. Responsibility for all stages of sample handling must be assigned and problems documented. A sample is in custody if it is in actual physical possession or is in a secured area restricted to authorized personnel. The necessary level of custody depends on a project's DQOs. While enforcement actions necessitate stringent custody procedures, custody in other types of situations (e.g., academic research) may be primarily concerned only with the tracking of sample collection, handling, and analysis.

Unless otherwise specified in a project FSP or test plan, the sample handling and custody procedures used for INEEL CERCLA activities will be as defined in TPR-4913, "Chain-Of-Custody and Sample Labeling for ER and D&D&D Projects." An example of the chain-of-custody form, sample logbook sheet, and sample label are provided in Appendix B.

2.3.1 Sample Handling

Samples must be properly prepared and shipped to the analytical laboratory in time to meet the holding times specified in Tables 2-1 and 2-2. Additions to or deviations from the guidelines in the tables (e.g., a test is required for which no requirements are listed or insufficient sample material will be available) are detailed in the project-specific FSP or test plan and the TOS prepared for the project.

2.3.2 Sample Shipping

Sample packaging, marking, labeling, and transporting will follow EPA guidance (EPA 1987b, Pages 6-8 through 6-16), and meet present INEEL and Department of Transportation requirements. Samples will be screened for beta-gamma in the field and for gamma- and alpha-emitting radionuclides prior to shipment to off-Site laboratories. Screening thresholds will be set in individual FSPs to ensure the SMO and off-Site laboratories are consulted when radiation thresholds are exceeded.

When shipping water samples that require preservation with acids, the language found in 40 CFR Part 136.3 must be considered. This part of 40 CFR designates the amounts of acids that may be present in aqueous samples without requiring designation as hazardous material under Department of Transportation regulations.

The exact language in 40 CFR 136.3, Table II, Footnote 3 is as follows:

> "When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR 172). The person offering such material for transportation is responsible for ensuring such compliance. For the

preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the hazardous materials regulations do not apply to the following materials: hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH of about 1.96 or greater); nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less)."

To calculate the maximum amount of acid that may be added to a water sample prior to shipment, the following equation is used

$$\text{number of milliliters of acid or base you may add to your sample} = \frac{(Wt.\%_{allowed})(Volume_{sample})(\rho_{sample})}{(\rho_{preservative})(Wt.\%_{starting})} \quad (1)$$

where

$Wt.\%_{allowed}$ = the weight percent of the material allowed in 40 CFR 136.3, Table II, Footnote 3.

$Wt.\%_{starting}$ = the weight percent of the acid (or base) that you are using as preservative. This information can be found on the label of the bottle. For example, Fisher brand, Optima grade, concentrated HNO_3 is 69–71% pure by weight; HCL is 35–37% pure by weight; and H_2SO_4 is 95–98% pure by weight. When a range is given, use the maximum to ensure that your calculation is conservative.

ρ_{sample} = the density of the water sample after the acid or base has been added (assume this is equal to 1.00 g/mL).

$\rho_{preservative}$ = the density of the acid or base preservative you are using in grams/milliliter.

$Volume_{sample}$ = the volume of the sample collected in milliliters.

2.3.2.1 Sample Containers. Sample containers will be precleaned using the appropriate cleaning protocol for the analytical method that will be used to analyze the sample. Any questions concerning appropriate cleaning protocol should be addressed to the SMO. Precleaned sample containers will be ordered from the supplier. A certificate of analysis for each container lot is not required but is highly recommended, and each order of containers will be associated with a lot number for traceability.

2.3.3 Sample Custody

Following EPA guidance (EPA 1987b, Pages 4-1 through 4-13) and ER procedures, a representative of the WAG will directly or indirectly supervise all activities concerning sample custody from field to shipment to the laboratory. As a routine portion of the SMO laboratory audits, the sample custody procedures used in the laboratories are reviewed to determine if those procedures are in accordance with EPA guidance.

A systematic character identification (ID) code is used to uniquely identify all samples. Uniqueness is required for maintaining consistency and preventing the same ID code from being assigned to more than one sample. The sampling activity field identification contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (field data, analytical data, etc.) to the information in the SAP table for data reporting, sample tracking, and completeness reporting. The analytical laboratory will also use the sample number to track and report analytical results. A two-character set (i.e., 01, 02) will be used then to designate the number of samples to be collected (e.g., field duplicate samples). The last two characters refer to a particular analysis type. Sampling and Analysis Plan tables are included in the Field Sampling Plan.

2.4 Analytical Method Requirements

One or more mobile and/or fixed analytical laboratories may be used during the investigations. The following must be considered before selection of a laboratory: the DQOs of the task, the laboratory's approval status and/or certification, the laboratory's status under the DOE-ID analytical services make or buy policy, and the laboratory's acceptance criteria regarding the radioactive content of samples. As part of the QA/QC program, each laboratory must be assessed and approved by SMO and Quality Assurance Unit personnel prior to use to evaluate its analytical procedures, calibration, and QA/QC program.

The SMO awards long-term (typically 3-5 years) Master Task Subcontracts (MTSs) to laboratories that perform the standard EPA and ASTM test methods for radiological, organic, inorganic, and miscellaneous classical analyses. These subcontracts are awarded by analytical discipline (i.e., radiological, organic, inorganic, and miscellaneous classical). The three MTS SOWs describe routine requirements for all laboratory operations common to every project's samples (e.g., sample custody/handling/storage, data reporting, delivery schedules). Each project that uses the MTS laboratories also has one or more task order SOWs prepared that describe any additional analysis requirements or deviations from the MTS SOWs. The laboratories are required by the MTS to have Chemical Hygiene plans, sample control procedures, and waste management procedures. Those documents are evaluated as part of the onsite audit and the implementation of those practices observed.

The SMO completes a cursory review on data received from the laboratories. Based on project DQOs, some of the data also undergoes a more thorough and structured analytical method data validation process. Both of those processes evaluate the adequacy of the data and look for indicators of a failure in the analytical system. If a failure is identified, the SMO works with the laboratory to correct the data, if possible, and requests corrective actions from the laboratory. In addition, if a problem is noted during analysis by the laboratory, the laboratory is required to contact the SMO to resolve the problem or reruns the analyses. The MTS SOWs and specific TOSs describe the data deliverable and the action required of the laboratory if an analytical system failure occurs. The laboratory must document system failures and corrective actions taken in the case narrative along with flagging any affected data.

2.4.1 Subsampling

Subsampling operations in the laboratory are critical for obtaining a measurement representative of the material contained in the sample collection vessel. Unless specific requirements for subsampling are specified in the project TOS, the laboratories will use internal SOPs for performing this task. The SMO reviews these procedures during onsite evaluations to ensure that the subsampling techniques are appropriate for obtaining a representative subsample.

2.4.2 Preparation of Samples

The appropriate preparation of samples is critical to ensure regulatory acceptance and technical defensibility of the data produced. The EPA has approved sample preparation techniques that are specific to the matrix of the sample and the analytes of interest. When these methods are used, the SMO ensures the appropriate sample preparation methods are called out in the TOS(s) prepared for each project. Because no standard EPA or ASTM sample preparation methods have been defined, the radiological MTS SOW allows laboratories to use their own internal SOPs for sample preparation, provided all specified criteria (e.g., total dissolution of solid samples) are adequately addressed. To ensure the laboratories under contract perform adequate sample preparation for radiological analyses, their SOPs for these operations are reviewed by the SMO during preaward onsite assessments.

2.4.3 Analytical Methods

All samples will typically be analyzed in the laboratory by EPA-approved methods, American National Standards Institute (ANSI) standard methods, ASTM industry-accepted, or other methods required by the MTS SOW and TOS prepared by the SMO (INEL 1995a, 1995b, 1995c). The following EPA methods may be used

- *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods* (EPA 1986)
- *Methods for the Chemical Analysis of Water and Wastes* (EPA 1983)
- *Statement of Work for Organic Analysis-Multi-Media, Multi-Concentration* (EPA 1999)
- *Statement of Work for Inorganic Analysis-Multi-Media, Multi-Concentration* (EPA 1993a)
- *Methods for the Determination of Organic Compounds in Drinking Water* (EPA 1988).

Required test methods that are not offered by any laboratory operating under a MTS are procured using a work order document referred to at the INEEL as a stand-alone SOW. Stand-alone SOWs are issued to interested laboratories under project specific Requests for Proposal (RFPs).

Specific analyses for samples will be documented in the project-specific FSP or test plan and, if a standard method is not used, detailed descriptions of the method or references will be provided. The most commonly used methods for geotechnical and physical property measurements are in Table 2-3. The most commonly used methods for radiological and hazardous constituent analysis are described in Tables 1-6 through 1-11. If samples are analyzed in the field, EPA-approved standard methods, nonstandard methods, or modified methods will be used as specified in the project-specific FSP or test plan. When project DQOs require the standard laboratory methods to be modified, these modifications will be specified in the TOS(s) prepared for the project. When these modifications result in deviations from the precision, accuracy, and detection limit information provided in this document, the details of the differences will be provided in the project FSP.

2.5 Quality Control Requirements

Internal quality control checks have been established for both field and laboratory methods. The QA objectives described in Subsection 1.4 of this QAPjP specifies how the project will be statistically evaluated. This section states how these specifications will be achieved.

Table 2-3. Physical property measurement methods.

Measurement Parameter	Reference	Sample Condition
Saturated hydraulic conductivity:		Undisturbed sample.
Constant head method	Klute (1986), Part 1, Page 694 or ASTM D2434-68/ D5084-90/D5856-95	
Falling head method	Klute (1986), Part 1, Page 700 or ASTM D2434-68/ D5084-90/D5856-95	
Unsaturated hydraulic conductivity:		Undisturbed sample.
Mualem method	Klute (1986), Part 1, Chapter 31	
Van Genuchten method	Van Genuchten (1980), Pages 892–898	
Moisture retention characteristic curve:		Undisturbed sample.
Porous-plate apparatus method (medium or coarse grained media)	Klute (1986), Part 1, Chapter 26 or ASTM D2325-68	
Pressure-membrane apparatus method (fine grained media)	Klute (1986), Part 1, Chapter 26 or ASTM D3152-72	
Porosity	Klute (1986), Part 1, Chapter 18 or ASTM C493-98	Porosity is often calculated using bulk density and particle density. Thus, the sample conditions listed in this table for bulk density should be followed.
Bulk density	Klute (1986), Part 1, Chapter 13	Undisturbed sample is desirable but sample may settle during sample transport. The sampling methods in Klute (1986), Chapter 13, must be followed to ensure accurate measurements of this property.
Atterberg limits	ASTM D4318-98	Sample may be disturbed.
Particle density	Klute (1986), Part 1, Chapter 13 or ASTM D854-98	Sample may be disturbed.
Particle size distribution: Mechanical sieve (particle sizes >75 μm) and hydrometer (particle sizes <75 μm)	Klute (1986), Part 1, Chapter 15 or ASTM D422-63	Sample may be disturbed.

Table 2-3. (continued).

Measurement Parameter	Reference	Sample Condition
Water content:		Sample may be disturbed/undisturbed.
Gravimetric	Klute (1986), Part 1, Page 503 or ASTM D2216-98	If disturbed, the bulk density of the soil must be measured to determine volumetric water content.
Volumetric	Klute (1986), Part 1, Page 494	
Specific Gravity of Soils:		
Maximum grain size <4.75 mm	ASTM D854-98	Sample may be disturbed.
Maximum grain size >4.75 mm	ASTM C127-88	Sample should not be disturbed.
Permeability:		
Soil (air permeability)	Klute (1986), Part 1, Chapter 48	
Rock (air permeability)	ASTM D4525-90	
Granular soils (grain size predominantly >75 μm)	ASTM D2434-68	
Viscosity of petroleum products	ASTM D445-97 or ASTM D2983-87	
Free liquid	SW-846 9095 (EPA [1986])	
Screening apparent specific gravity and bulk density of waste	ASTM D5057-90	
Total organic carbon in soil	Klute (1986), Part 2, Chapter 29	Sample may be disturbed but not sieved.
Mineralogy (x-ray diffraction)	ASTM D934-80	Sieve through 35-mesh sieve.
Cation exchange capacity	SW-846 9081 (EPA [1986]) or Page (1982), Part 2, Chapter 8	Sample may be disturbed but not sieved.
Inorganic carbon	Page (1982), Part 2, pages 181–189	Sample may be disturbed.
Iron oxide/hydroxide	Klute (1986), Part 1, Chapter 6	Sample may be disturbed.
pH	Page (1982), Part 2, Chapter 12 or ASTM D4972-95a	Sample may be disturbed.
Heat capacity/specific heat	Klute (1986), Part 1, Chapter 38 or ASTM D4611-86	Sample may be disturbed.
Thermal conductivity/diffusivity	Klute (1986), Part 1, Chapter 39 or ASTM D5334-92	Undisturbed sample.
Laboratory compaction characteristics of soil using standard effort	ASTM D698-91	Sample may be disturbed.

Table 2-3. (continued).

Measurement Parameter	Reference	Sample Condition
Density and unit weight of soil in place by the sand-cone method	ASTM D1556-90	In situ
Laboratory compaction characteristics of soil using modified effort	ASTM D1557-91	Sample may be disturbed.
Unconfined compressive strength of cohesive soil	ASTM D2166-98a	Undisturbed sample.
One-dimensional consolidation properties of soils	ASTM D2435-96	Undisturbed sample.
Unconsolidated, undrained compressive strength of cohesive soils in triaxial compression	ASTM D2850-95	Undisturbed sample.
Density of soil and soil-aggregate in place by nuclear methods (shallow depth)	ASTM D2922-96	In situ
Water content of soil and rock in place by nuclear methods (shallow depth)	ASTM D3017-96	In situ
Surface area (multi-point bet)	ASTM C1069-86 (1997)	Disturbed sample.
Surface area (water sorption)	Soils Science Society of American Journal (SSSAJ) 1982	
Partition coefficients	ASTM D4319-93 ASTM E1147-92	Undisturbed or disturbed sample.
Extractable metals	SW-846, 3050	
Calculated total porosity	Methods of soil analysis (MOSA), Chapter 18	
Calculated unsaturated hydraulic conductivity	SSSAJ, 1980	
Hydraulic conductivity	ASTM D-5058-990, 1997	
Split tensile strength	ASTM C-496-96	

2.5.1 Field Quality Control Requirements

Several types of internal QC checks that may be collected during field sampling include duplicate samples, split samples, field blanks, trip blanks, equipment blanks, and PE samples as shown in Table 1-5 or in the sample plan tables in the project-specific FSP or test plan. A discussion regarding the statistical evaluation of QC indicators is contained in Section 4.3 of this QAPjP.

2.5.2 Laboratory Quality Control Requirements

The internal laboratory QC checks, including the type and frequency of QC samples and calculation of data quality indicators, are described in the laboratory SOW, which is prepared by the SMO (INEL 1995a, 1995b, 1995c). The laboratory MTS SOWs contain specific acceptance limit criteria for the QC check measurements required by the methods (e.g., method blanks, matrix and surrogate spikes, and calibration checks) and required corrective action when these limits are exceeded. If more stringent criteria than those specified in the MTS SOWs are required for a project, they will be described in the FSP and TOS.

The MTS SOWs delineate the specifications for the applicable data quality indicators, including the formulas used to measure those indicators. Analytical method data validation technical procedures identify the processes used to evaluate and qualify data that are non-compliant with their associated MTS SOWs. Laboratories are required to maintain quality control charts for data that are generated by analytical methods that require such charts. Confirmation that required charts are being maintained by the laboratories can be obtained either through onsite audits or by requesting copies of those charts be sent directly to the INEEL.

The MTS SOWs require adequate spare parts and/or backup instrumentation. Existence of critical spare parts, maintenance contracts, and/or backup instrumentation is verified during the onsite laboratory audit.

The effectiveness of laboratory corrective actions is determined by continuing to monitor the laboratories' performance using the Laboratory Performance Evaluation Program (LPEP). The LPEP provides monitoring and assessment guidelines used to ensure that high quality, defensible analytical data are being supplied by subcontracted and government-operated laboratories that support the DOE programs at the INEEL.

Interpretation of PE sample results is included in the analytical method data validation reports issued for radiological analyses (when these samples are specified for use in a FSP). When PE samples are included for other analyses (as specified in a FSP), the method for evaluating the results of these samples will also be described in the FSP.

2.6 Instrument Testing, Inspection, and Maintenance Requirements

The INEEL contractor maintains a calibration program in compliance with ANSI/National Conference of Standards Laboratories (NCSL) Z540.1 or equivalent. That program controls measuring and test equipment used in the field and onsite laboratory. The FTL ensures equipment of the proper type, range, accuracy, and precision is used to provide data compatible with project requirements and desired results.

Preventive maintenance for field equipment is addressed in site-specific FSPs, test plans, or work plans. Preventive maintenance includes routine source or calibration gas checks of field instrument and

periodic recalibration of the instrument. Records of the calibrations, source checks, and calibration gas checks, where applicable, will be maintained consistent with the FFA/CO requirements.

2.7 Instrument Calibration

The FTL ensures that the field sampling equipment is calibrated appropriately per manufacturer's recommendations. The RCT is responsible for maintaining and documenting the calibration of the radiological equipment, and the industrial hygienist is responsible for maintaining and documenting the calibration of the Industrial Hygiene equipment. Calibration of field instruments will be documented in a field instrument calibration/standardization logbook.

Specific procedures for initial approval of analytical laboratories have been established by the contractor. Equipment will be calibrated according to the manufacturer's recommendations and SOWs, which define calibration frequency and acceptance criteria.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables

The supplies and consumables used during ER activities include sample containers, chemicals, deionized water, and potable water. Sample containers are received by the field team and verified clean using the certifications provided by the supplier. The acceptance criteria for the containers are correct quantity and size, correct container type, and certified clean. If additional supplies are required (e.g., standards for field measurements), details concerning the certifications, inspection/acceptance testing requirements, acceptance criteria, testing method, frequency of testing, and responsible individuals will be detailed in the project-specific FSP.

All chemicals used as a preservative will be of high purity and purchased from a nationally recognized supplier of chemicals and inspected by the field team before use. The correct grade and type of chemical will be verified using the container label and accompanying documentation.

Deionized water is obtained from a reputable supplier of deionized water or obtained from one of the available onsite sources. If the deionized water is obtained from a supplier, the marking on the container is used to verify that the water is deionized. If the water is obtained from one of the onsite supplies, data from the last test of the water system are used.

Potable water is used at various points in the process and no acceptance or verification of that water is done specifically to verify acceptability for use on the project. If potable water is used in the decontamination process, the final rinses are with deionized water, thus eliminating the need to verify the quality of the potable water.

The FTL is responsible for documenting the inspections in the FTL logbook. The documentation in the logbook will include unique identification of the supplies, the date received, the date tested, the date retested (if applicable), and the expiration date for supplies having an associated shelf life. If the supplies or consumables are inspected by the on-Site quality receiving inspection organization, a green 'accept" tag will be attached to the item or container. That green tag will be retained with the project files.

The FTL is responsible for verifying that all supplies and consumables have been inspected before those supplies are used. That verification should be part of the prejob evaluation of readiness.

2.9 Data Acquisition Requirements (Nondirect Measurements)

Environmental Restoration uses nondirect measurement data during various phases of a project. Nondirect measurement data are data from previously collected samples or process information that will be used on a specific project. When that type of data is used, the WAG manager evaluates the data against the following criteria and documents the evaluation in the project files for the WAG.

- Representativeness: Were the data collected from a similar population?
- Bias: Are there characteristics of the data that would shift the conclusions?
- Precision: How is the spread in the results estimated?
- Qualifiers: Are the data evaluated in a manner that permits logical decisions on whether or not the data are applicable to the current project?
- Summarization: Is the data summarization process clear and sufficiently consistent with the goals of the project?

The documented evaluation will include any limitations on the use of the data and the nature of the uncertainty of the data.

2.10 Data Management

This section summarizes the processes used to generate, validate, interpret, track, store, and retrieve data at the INEEL.

2.10.1 Data Recording

During the data acquisition process, raw (as-collected) data are typically subject to mathematical operations that reduce the data to a meaningful expression (e.g., a concentration in a specific unit). The internal checks used by ER to ensure data quality during data encoding by laboratories in the data entry process is accomplished by using the raw data to manually verify the concentrations reported. The formulas used for these manual verifications are documented in the SMO analytical method data validation TPRs. During data entry in electronic databases, data verification procedures involving second person review of the data entered ensures the quality of the electronically captured data.

2.10.2 Data Validation

Analytical method data validation is the review of measurements and analytical results to confirm those method requirements have been achieved. The primary purpose of analytical method data validation is to ensure the legal and/or technical defensibility of the data. Therefore, analytical method data validation should be performed on all data that may be used to decide the final action at a site. The SMO is responsible for analytical method data validation. The SMO defines two levels of analytical method data validation (AMDV): Level A and B AMDV.

Level A AMDV is a thorough process that consists of data confirmation, data clarification, and data appraisal. Data confirmation is the process of correlating the reported data within a given data package to its corresponding raw data. Data clarification is the process of qualifying or flagging reported analytical results based on strict adherence to their applicable validation SOP (TPRs 80, 81, 82, 132, and

174) and/or justifiable professional judgement by the data validator. Data appraisal is the formulation of a comprehensive limitations and validation (L&V) report that documents the entire AMDV process.

Level B AMDV is a superficial process that includes only data clarification and data appraisal.

Analyses obtained using a laboratory SOW prepared by SMO will generate adequate QC information to satisfy the required level of validation. The procedures for AMDV, including determining outliers and appropriate qualification flags, are outlined in the following TPRs:

- TPR-80, "Radioanalytical Data Validation"
- TPR-82, "Validation of Volatile and Semivolatile Organic Gas Chromatography/Mass Spectrometry Data"
- TPR-81, "Validation of Gas Chromatographic Data"
- TPR-132, "Inorganic and Miscellaneous Classical Analyses Data Validation."
- TPR-174, "Validation of Semi-Volatile Organic Compounds Data Analyzed Using Gas Chromatography/Mass Spectrometry (GC/MS)."

Environmental Restoration has prepared guidance for field data validation. Additional data validation information can be found in Guide (GDE)-7003, "Levels of Analytical Method Data Validation."

2.10.3 Data Transformation

Data reporting requirements during the data collection, transfer, storage, recovery, and processing steps, including laboratory and field QC, and the organizations responsible, are documented in contractor procedures. Use of logbooks and chain-of-custody forms are also described in contractor procedures. Sample and data storage requirements are addressed in the MTA and applicable stand-alone SOWs.

Data transformation involves conversion of individual data point values or possibly symbols using conversion formulas (e.g., unit conversion or logarithmic conversion) or a system for replacement. Most data conversions used in ER data acquisition are performed at the analytical laboratories or in the field during the performance of field measurements. All requirements for data transformation are detailed in the analytical methods used for data acquisition. If additional data transformation operations are required, they will be specified in FSPs.

2.10.4 Data Reduction

The calculations that will be used to evaluate the precision, accuracy, representativeness, completeness, and comparability parameters are in Section 4.3 of this QAPjP. Data reduction occurs at two points in the data collection and interpretation process: in the laboratory and following receipt of the data. Reduction of raw laboratory data will be performed by the laboratory following SMO reviewed and approved procedures. Data reduction of the analytical data for interpretation, if required, may occur in conjunction with a statistician and will be documented in the project report.

2.10.5 Data Analysis

Data analysis involves comparing reduced data with a conceptual model (e.g., dispersion model or groundwater vadose zone transport model). This can involve computation of summary statistics, standard errors, confidence intervals, tests of hypotheses relative to model parameters, and goodness-of-fit tests. The project-specific FSPs will briefly outline the proposed methodology for data analysis to be conducted for the project. More detailed discussions are provided in reports summarizing project data.

2.10.6 Data Tracking

Data are tracked through the data processing system using the SMO Sample and Data Tracking System (SADTS). Tracking of samples and data is initiated when the data entered in the SAP table application is uploaded to SADTS. These data indicate the sample numbers for which collection is planned. The chain-of-custody information submitted to the SMO is then used to begin tracking collected samples. Sample collection dates, laboratory sample receipt, receipt of data from the laboratory, submittal of data for data validation, transmittal of the validation report, and sample waste disposal are all recorded in the SADTS.

2.10.7 Data Storage and Retrieval

Hard copies of analytical data received are stored in the SMO data storage areas as quality assurance records in accordance with the *Records Management Plan for the Idaho National Engineering Laboratory Environmental Restoration Program* (INEL 1995d). Electronic data are initially entered in the SMO Integrated Environmental Data Management System (IEDMS) and are subsequently uploaded to the Environmental Restoration Information System (ERIS). All security requirements for electronic data are described in the *Data Management Plan for the Idaho National Engineering Laboratory Environmental Restoration Program* (INEL 1995e).

3. ASSESSMENT/OVERSIGHT

3.1 Assessments and Response Actions

Two general evaluations are to be conducted: system evaluations/assessments and PE/assessments. Project-specific scheduling of assessments is documented in the FSP. Post evaluation reports are also described in this section.

3.1.1 Field Surveillance

At least one system/PE (i.e., self-assessment, quality field surveillance, independent assessment) will be performed and documented (e.g., field surveillance checklist) to ensure that the sample documentation, collection, preparation, storage, and transfer procedures are in place before or shortly after field activities start. The evaluation or combination of evaluations to be performed for a project, will be specified in the FSP, test plan, etc. The project manager identifies a project schedule on the ER planned field schedule. The evaluations will verify that the sampling organization is operational, written procedures for sampling are available and being followed, specified equipment is available, calibrated, and in proper working order, and work is done in compliance with this QAPjP. Deficiencies noted during those assessments are entered into an electronic database for tracking.

3.1.2 Contractor Expanded Review

This qualitative assessment may be used to determine a project's readiness to proceed. The contractor-expanded reviews (CERs) may be done by the INEEL contractor or DOE/ID personnel. The level of rigor used in completing a CER depends on the complexity of the activity. For simple field screening activities, a peer review may be done to satisfy the CER. In highly complex activities where risk may be moderate or high, a rigorous readiness review may be done to satisfy the CER requirements.

3.1.3 Readiness Reviews

Readiness reviews, as defined by the DOE, are "systematic, documented, performance-based examinations of facilities, equipment, personnel, procedures, and management control systems to ensure that a facility will be operated safely within its approved safety envelope as defined by the facility safety basis." This definition is similar to the one provided in EPA QA/G-5. Readiness reviews are done for relatively high-risk activities and less rigorous readiness assessments or management system reviews are completed for the lower risk activities. In either case, individuals with appropriate technical expertise are asked to review the preparedness of the activity before that activity starts. That review culminates in a recommendation to start the field activities. Routinely, the same type of review is not done at the initiation of a project, but is done only before fieldwork starts.

3.1.4 Technical Systems Audits

Technical systems audits are not routinely completed as a single activity but rather a collection of self-assessments and management assessments completed over the life of the project. Routine self-assessments evaluate compliance with the HASP, procedures, and training requirements. Those assessments include the use of FTL checklists, quality assurance surveillances, real-time monitoring by RCTs, industrial hygienists, industrial safety professionals, and environmental specialists. In addition, the DOE conducts independent evaluations of field activities to verify compliance to requirements. Both the IDEQ and EPA may participate in any or all the assessments discussed.

3.1.5 Performance Evaluation

Performance evaluation samples are used by projects to evaluate the proficiency of the laboratory. Specific PE sample requirements are listed in the FSP. Interpretation of PE sample results is included in the analytical method data validation reports issued for radiological analyses. When PE samples are included for other analyses, the method for evaluating the results of those samples is described in PLN-862, "Performance Evaluation Sample Program Plan," or in the FSP.

3.1.6 Audit of Data Quality

Processes used at the INEEL to audit data quality are cursory reviews and AMDV (see Sections 2.10 and 4 of this QAPjP). Additional data reviews are specified in the FSP, test plan, or work plan.

3.1.7 Data Quality Assessment

Data Quality Assessments (DQAs) are completed at various stages of a project. At the completion of the RI/FS phase, a DQA is completed. Also, at the end of the remedial action, a DQA is completed and documented as part of the remedial action report. The process entails reviewing analytical method validated data against DQOs to evaluate acceptability of total measurement error. Various statistical tools are used to complete DQAs. The project-specific documents describe the statistical methods used on that project.

3.1.8 Documentation of Assessments

Evaluation reports will be completed by the person(s) doing the evaluation. The report will document, as a minimum, the date of the assessment, the name(s) of the assessors and persons contacted, activities assessed, deficiencies, and other pertinent information. A reference will be made in the report to the deficiency numbers in the electronic database. Scheduling of the assessments and organizations responsible for the assessments are established by the FSP, work plan, test plan, or by agreement with the DOE, EPA, and IDEQ.

3.2 Report to Management

Project reports (e.g., RI report, summary report, RA report) will summarize and/or reference all documentation that impacts the DQOs of the project. The recipients of the reports are defined in the FFA/CO and work plans. The FFA/CO requires monthly written progress reports that describe the actions taken during the previous month. In addition, the monthly report will describe activities scheduled for the next 3 months. The DOE, IDEQ, and EPA will define additional reporting requirements. The report will be written by the INEEL contractor for the DOE. Reports will be provided to DOE-ID, IDEQ, and EPA, with copies to DOE and INEEL contractor WAG managers.

Results of DQA and other evaluations of project compliance to FFA/CO or QAPjP requirements will be provided to the DOE, EPA, and IDEQ as part of the monthly report or as part of individual OU RI/FS and RA reports.

4. DATA VALIDATION AND USABILITY

4.1 Data Review, Validation, and Verification Requirements

This section states the criteria for deciding the degree to which each data item has met its quality specifications. Detailed discussion of the following areas is located in the previous sections.

- *Sampling Design.* Acceptance tolerances for each critical sample coordinate and the action to take, if the tolerances are exceeded, are specified in FSPs.

- *Sample Collection Procedures.* Details of how a sample is separated from its native time/space location are provided in Subsection 2.2, "Sampling Methods Requirements." Acceptable departures (for example alternate equipment) from those methods stated in this document or the FSP, and the action to be taken if the requirements cannot be satisfied, will be documented in the FSP or test plan.

- *Sample Handling.* Details of how a sample is physically treated and handled during relocation from its original site to the actual measurement site are given in Subsection 2.3, "Sample Handling and Custody Requirements." At a minimum, the sample containers and preservatives will be evaluated when Level A analytical method data validation is performed by the SMO to ensure they were appropriate for the nature of the sample and the type of data generated from the sample. Also, checks on the identity of the sample (e.g., proper labeling and chain-of-custody records) will be made to ensure the sample continues to be representative of its native environment as it moves through the analytical process.

- *Analytical Procedures.* All sample data received by the SMO are verified to ensure the procedures used to generate the data were implemented as specified in the FSP and TOS. This is done within the limitations of the data package received. For example, there is no means to verify that a specific analytical method was used when all that is received from a laboratory is a summary sheet listing a method number. When these abbreviated data packages are received, the SMO can only verify that the number on the reporting form corresponds to the method number requested. No raw data can be reviewed to verify the method criteria were met or that the method was actually used. Acceptance criteria and the suitable codes (flags) for characterizing each sample's deviation from the procedure are described in Subsection 2.4, "Analytical Methods Requirements" and in the analytical method data validation TPRs used by the SMO.

- *Quality Control.* The specified QC checks, the procedures, acceptance criteria, and corrective action are specified in Subsection 2.5, "Quality Control Requirements." When Level A or B analytical method data validation is performed by the SMO, the fact that required corrective actions were taken, which samples were affected, and the potential effect of the actions on the validity of the data are documented in L&V reports.

- *Calibration.* The calibration of instruments and equipment is addressed in Subsection 2.7, "Instrument Calibration." When Level A or B analytical method data validation is performed by the SMO, calibration requirements are addressed. Specifically, the fact that required corrective actions were taken when calibration criteria were exceeded, which samples were affected, and the potential effect of the actions on the validity of the data are documented in L&V reports.

- *Data Reduction and Processing.* How information generation is checked, the requirements for the outcome, and how deviation from the requirements will be treated are addressed in Subsection 2.10, " Data Management."

4.2 Validation and Verification Methods

The details of the process for validating (determining if data satisfy QAPjP-defined user requirements) and verifying (ensuring that conclusions can be correctly drawn) project data are given in Section 2.10.2, "Data Validation." The project is responsible for specifying in the project-specific FSP the level of analytical method data validation that will be used. Upon data receipt, the SMO is responsible for verifying that the method requested in the FSP, test plan, TOS and/or SOW was the method used to analyze samples. The SMO is also responsible for completion of any other analytical method data validation required in the FSP or test plan. The project is then responsible for completion of DQA.

4.3 Reconciliation with Data Quality Objectives

Data Quality Assessment is a key part of the assessment phase of the data life cycle. A DQA protocol will be developed for each investigation, which will determine how well the validated data can support their intended use. When applicable, the guidance for conducting DQA found in "Guidance for Data Quality Assessment" (EPA 1998b) will be used. During DQA, one or more of the subjects discussed in the following subsections will typically be involved.

4.3.1 Corrective Action

Corrective action procedures are implemented when samples do not meet QA/QC established standards. Two types of corrective action are discussed: laboratory corrective action(s) and field corrective action(s).

4.3.1.1 Laboratory Corrective Action(s). The laboratory manager, SMO, and the project manager are responsible for ensuring that laboratory QA/QC procedures are followed. Laboratory situations requiring corrective actions, the appropriate corrective action, and the documentation requirements will be specified in the laboratory SOW prepared by the SMO in accordance with MCP-3480, "Environmental Instructions for Facilities, Processes, Materials, and Equipment." If notified by the laboratory of a situation that may impact the DQOs of the project, then the SMO will notify the project manager of the situation and the corrective actions being implemented.

4.3.1.2 Field Corrective Action(s). The FTL and project manager are responsible for ensuring that field QA/QC procedures are followed. If a situation develops that may jeopardize the integrity of the samples, the FTL and project manager will document the situation, the possible impacts to the DQOs of the project, and the corrective actions taken. The project manager will notify or consult with appropriate individuals. The situation and impacts on the DQOs of the project will be described in the Track 2 scoping summary report or RI report.

4.3.2 Calculation of Data Quality Indicators

The data quality indicators of precision, accuracy, and completeness are addressed in Subsection 1.4, "Quality Control Objectives," and Section 2.5, "Quality Control Requirements" of this QAPjP. The equations that will be used to calculate and report those data quality indicators are described in this section. Unless otherwise indicated, all calculations are per EPA guidance (EPA 1991a, Pages 43-45).

4.3.2.1 Precision. Typically, one of four common calculations will be used to assess various measurements for precision. The RPD or RSD is calculated for every contaminant for which field or laboratory duplicates and/or splits exist. The precision of the absolute range (PAR) can be used when the absolute variation between two measurements is more appropriate. The mean difference (MD) is a standard statistical method of assessing the difference between two radioactivity measurements and determining the significance of that difference.

The RPD is used when there are two observed values (i.e., field collocated duplicates, field splits, laboratory duplicates, laboratory matrix spike/matrix spike duplicates). The RSD is used when there are more than two observed values.

The RPD for duplicate or split samples is calculated by

$$RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2}\ (100\%) \tag{2}$$

where

RPD = relative percent difference

C_1 = larger of the two observed values

C_2 = smaller of the two observed values.

If the two sample concentrations are less than the method detection limit, the RPD is not calculated. If one sample concentration is less than the detection limit, then one half of the method detection limit can be used in the RPD calculation. A note referring to the method used for the calculation of a reported RPD for duplicate sample results will be provided with all precision calculations.

The RSD for three or more observed values is calculated as follows:

$$\%RSD = \left(\frac{s}{\bar{x}}\right) 100 \tag{3}$$

where

RSD = relative standard deviation

s = standard deviation

$\bar{x}$ = mean of observations.

The standard deviation is calculated by

$$s = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}} \tag{4}$$

where

s = standard deviation

x_i = measured value of the ith observation

$\bar{x}$ = mean of observation measurements

n = number of observations.

For measurements such as pH, where absolute variation is more appropriate, the PAR of duplicate measurement calculation can be used in lieu of the standard deviation.

PAR is calculated by:

$$D = \left| m_1 - m_2 \right| \tag{5}$$

where

D = absolute range

m_1 = first measurement

m_2 = second measurement.

Precision of radionuclide measurements is determined using the mean difference calculation:

$$MD_p = \frac{\left| S - D \right|}{\sqrt{\left(\sigma_S^2 + \sigma_D^2 \right)}} \tag{6}$$

where

MD_p = the statistical difference of the duplicate results

S = the sample result (as pCi/g or pCi/L)

D = the duplicate sample result (as pCi/g or pCi/L)

σ_D = the associated total propagated 1σ uncertainty of the duplicate result (as a standard deviation)

σ_s = the associated total propagated 1σ uncertainty of the sample result (as a standard deviation).

4.3.2.2 Accuracy. Two calculations will be used to assess laboratory accuracy: %R of the MS and %R of known and/or blind LCS.

The %R of the MS is calculated by:

$$\%R = \frac{C_i - C_0}{C_t} \; x\; 100\% \tag{7}$$

where

%R = percent recovery

C_i = measured concentration of spiked aliquot

C_0 = measured concentration of unspiked aliquot

C_t = concentration of spike added, expressed as a weight to volume ratio (i.e., weight of applicable analyte spiked into sample aliquot per final volume of spiked sample aliquot).

The %R of a known and/or blind LCS or a standard reference material (SRM) is calculated as

$$\%R = \frac{C_m}{C_a} \; (100\%) \tag{8}$$

where

%R = percent recovery

C_m = measured concentration of the SRM or the LCS

C_a = actual or certified amount of analyte in the sample.

For determining accuracy of radionuclide measurements compared to a known value, the mean difference calculation is used where:

$$MD_a = \frac{|S - K|}{\sqrt{\left(\sigma_s^2 + \sigma_k^2\right)}} \tag{9}$$

where

MD_a = the statistical difference of the PE sample result and the known value

S = the PE sample result (as pCi/g or pCi/L)

K = the certified activity (as pCi/g or pCi/L) for the known sample (LCS or PE sample)

σ_k = the associated total propagated 1σ uncertainty of the known (as a standard deviation)

σ_S = the associated total propagated 1σ uncertainty of the sample result (as a standard deviation).

4.3.2.3 Completeness. One calculation will be used to assess completeness. Completeness is calculated by:

$$\%C = \frac{S_a}{S_t} x\ 100\% \tag{10}$$

where

%C = percent completeness

S_a = number of samples for which acceptable data are generated

S_t = the total number of samples planned in the FSP.

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Appendix A

Additional FSP Requirements

Appendix A

Additional Field Sampling Plan Requirements

In accordance with this Quality Assurance Project Plan (QAPjP), the following additional items must be included in a Field Sampling Plan (FSP).

- Title page
- Table of contents
- Site background
- Sampling objectives
- Sample location and frequency
- Presampling meeting
- Sample designation
- Sampling equipment and procedures
- Sample handling and analysis
- Waste management
- Site map
- Specification of data categories
- Target validation levels
- Target analytical levels
- Critical samples
- Specific procedure for any nonstandard methods (a copy of the procedure should be attached to the FSP)
- Accuracy, precision, and detection limit data (as applicable) for any method used and not included in the QAPjP
- Organization chart
- Detection limits for methods presented in this QAPjP when method deviations will result in detection limits different from those listed
- Quality assurance objectives, if different from those in QAPjP

- Analytical error determinations for screening data collected from field measurements
- Waste minimization/waste management plans for sampling waste streams
- Decontamination procedures
- Specific sampling procedures
- Additions to, or deviations from, the sample container size, sample mass, preservatives, etc. listed in the tables in the QAPjP
- Specific alternative chain-of-custody procedure(s) if TPR-4913, "Chain of Custody and Sample Labeling for ER and D&D&D Projects," will not be used
- Preshipment sample screening procedures
- Justification for use of screening data without 10 percent definitive data used as confirmation (when applicable)
- Inspection/acceptance requirements for supplies and consumables not provided in Section 2.8. of this QAPjP
- Data management functions not specified in Section 2.10 of this QAPjP
- Proposed method of data quality assessment.

Appendix B

Examples of Forms Used

Appendix B

Examples of Forms Used

WAG 5 REMEDIAL ACTION – PHASE 1

SAMPLE ID: 5RA203013A
DATE (ddmmmyyyy)
LOCATION: CONTAINER #2 - VAULT
ANALYSIS: Analysis Suite #1

TIME:
SAMPLER:
DEPTH: NA

PRESERVATIVE: 4°C

5RA203013A

WAG 5 REMEDIAL ACTION – PHASE 1

SAMPLE ID: 5RA203013A
DATE (ddmmmyyyy)
LOCATION: CONTAINER #2 - VAULT
ANALYSIS: Analysis Suite #1

TIME:
SAMPLER:
DEPTH: NA

PRESERVATIVE: 4°C

5RA203013A

WAG 5 REMEDIAL ACTION – PHASE 1

SAMPLE ID: 5RA202023A
DATE (ddmmmyyyy)
LOCATION: CONTAINER #1 - VAULT
ANALYSIS: Analysis Suite #1

TIME:
SAMPLER:
DEPTH: NA

PRESERVATIVE: 4°C

5RA202023A

WAG 5 REMEDIAL ACTION – PHASE 1

SAMPLE ID: 5RA202023A
DATE (ddmmmyyyy)
LOCATION: CONTAINER #1 - VAULT
ANALYSIS: Analysis Suite #1

TIME:
SAMPLER:
DEPTH: NA

PRESERVATIVE: 4°C

5RA202023A

WAG 5 REMEDIAL ACTION – PHASE 1

SAMPLE ID: 5RA202013A
DATE (ddmmmyyyy)
LOCATION: CONTAINER #1 - VAULT
ANALYSIS: Analysis Suite #1

TIME:
SAMPLER:
DEPTH: NA

PRESERVATIVE: 4°C

5RA202013A

435.20
05/16/2000
Rev. 01

INEEL SAMPLE MANAGEMENT OFFICE
CHAIN OF CUSTODY FORM

See Instructions On Back

Page _____ of _____

[1] Sampler (Printed):	[2] Sampler (Signature):	[3] Project Name:
[4] Laboratory Shipped To:		[5] Sampling & Analysis Plan Number: / [6] TOS/SOW/PSR Number:

[7] Sample ID#	[8] Sample Date	[9] Sample Time	[10] Sample Location	[11] Depth	[12] Sample Matrix	[13] Analysis Type No(s)	[14] Preservative	[15] Remarks

[16] Comments:

Cooler Number(s):

[17] Relinquished By (Printed)	[18] Relinquished By (Signature)	[19] Date	[20] Time	[21] Received By (Printed)	[22] Received By (Signature)	[23] Date	[24] Time

Distribution: Original & Yellow: Accompany Shipment To Laboratory Pink: Forward To Sample Management Green: Retained By Project

435.20
05/16/2000
Rev. 01

INEEL SAMPLE MANAGEMENT OFFICE
CHAIN OF CUSTODY FORM

INSTRUCTIONS

1. Print full name of Sampler.

2. Signature of Sampler.

3. Print project name.
This shall be the same project name that is used in the appropriate Task Order Statement of Work (TOS) or Statement of Work (SOW) that has been entered into Box 6 of this form.

4. Print the name of the laboratory where sample(s) will be shipped.

5. Print the Sampling & Analysis Plan Document Number.
(An abbreviated Sampling & Analysis Plan Document, Characterization Plan Document, Field Sampling Plan Document, or Test Plan Document number may be used.)

6. Print complete TOS or SOW number. If a PSR form is being used, enter complete PSR number. This field must be completed or use "N/A" if appropriate. Include Revision Number or applicable revision suffix code (e.g., ER-TOS-XXXXR1).

7 Print sample identification numbers legibly.
NOTE: Ensure that the information on each sample container match the Chain-Of-Custody Form 435.20 sample identification numbers exactly. (Sample identification numbers shall match the sample label exactly.)

8. – 11. Enter sampling date, time, location, and depth for each sample. Enter "N/A" if appropriate.
(Enter the sample location that appears on the label/SAP table, if one has been produced.)

12. Print sample matrix description. For any given sample, identify the matrix as either:

a. it is specifically and unambiguously defined in the associated TOS/SOW (the terminology used to identify the matrix of each sample on this COC form shall exactly match the terminology used in Table 1 of the applicable TOS/SOW), or
b. when not specifically and unambiguously defined in the associated TOS/SOW (e.g., matrices generically identified as either unspecified liquids or unspecified solids in Table 1 of the TOS/SOW), the sampler shall identify its matrix on this COC as clearly and unambiguously as possible.

13. Print Analysis Type Number(s).
Analysis Type Number(s) can be found in Table 1 of the appropriate TOS or SOW.

14. List preservative for each sample, if used. Enter "N/A" if appropriate.

15. Print appropriate Remarks.
Examples of appropriate Remarks are:
QC Rinsate
Bottle Not Filled Complete

16. Print appropriate Comments.
Examples of appropriate Comments are:
Field Team Leader Name
No More Samples Will Be Shipped Under (state TOS or SOW number)
NOTE: Comments that change the scope of the associated TOS or SOW are inappropriate.

17. Print the name of the Sampler relinquishing the sample(s).
NOTE: Ensure that the name of the Sampler relinquishing the sample is the same as the name listed in Box 1.

18. Signature of Sampler relinquishing the sample(s).

19. – 20. Date and Time sample(s) were relinquished by the sampler.

21. – 22. Printed name and signature of personnel receiving the sample(s).

23. – 24. Date and Time sample(s) were received.

NOTE: Your signature on this form documents your review of all information on this COC.
- Ensure errors are corrected by drawing a single line through the incorrect information and entering the correct information.
- Ensure all corrections are initialed and dated.
- Ensure That:
  - Offsite Lab – The date and time that the COC is taped into the top of the cooler is recorded.
  - Onsite Lab – The laboratory sample custodian records that the samples were received at the exact date and time as recorded by the relinquishing sampler.